The Comparison Of The Effect Of Task-Oriented Training And Progressive Resistance Training In Stroke Subjects on Upper limb function and Quality of life in Stroke subjects- A Randomized Clinical Trial.

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Abstract: Background And Objectives: Task-oriented training (TOT) and Progressive resistance training (PRE) are two techniques which has proved its effectiveness in treatment of stroke subjects. The majority of evidence focuses on chronic stroke and supports TOT use at this stage of recovery. Although the studies are fewer in number, the evidence also supports TOT as an effective intervention for the UE post stroke in the sub acute stage of recovery. Previous literature has also suggested for its comparison and best can be recommended for clinical practice. So, the aim of this study is to compare the effect of TOT and PRE on upper extremity motor recovery and functional status in sub acute stroke subjects. Materials And Methods: Total of 40 stroke subjects who is having minimal motor criterion and met other inclusion criteria were recruited from department of physiotherapy, central referral hospital. Subjects were randomized into two group i.e. TOT (Group A) and PRE (Group B). Pre and post intervention outcome measures were taken using Action research arm test, Box and Block test, Fugl‑Meyer assessment, overall functional status by Modified Barthel index and Quality of life by Stroke Specific Quality of life questionnaire. Result: At baseline subjects of both group showed no significant differences regarding ARAT, BBT, FMA, MBI and SS-QOL scores but after 3 weeks of intervention, subjects of both group showed statistically significant improvements in all the variables measured ($p<0{\cdot}05$). There was significant improvement in TOT group compared to the PRE group. Conclusion: The present study confirms that TOT is an effective treatment technique to improve upper extremity motor recovery, hand and finger dexterity, functional status and quality of life in stroke subjects compare to PRE. It is cost effective, easy and safe method for rehabilitation and most important can be easily administered at home by the subjects. Overall, clinicians will consider their stroke subjects stage of recovery and TOT to implement for their particular practice setting, in the context of the evidence supporting. [Chowan N Natl J Integr Res Med, 2019; 10(5): 19-27]

Key Words: Task oriented training, Quality of life, Stroke, Upper extremity, Resistance training

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Introduction A stroke is a clinical syndrome characterized by rapidly developing clinical symptoms and or signs of focal, and a time global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin (WHO).[1] The effects of a stroke depend on the site and severity of brain injury. Three quarters of stroke occurs in the region supplied by middle cerebral artery, as a consequence the upper limb is affected in large number of subjects.[2] It has been reported that up to 85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have continued to have limitations in upper-extremity functioning.[2]

Upper limb neuromuscular weakness occurs frequently after stroke with loss of muscle strength and dexterity together considered producing the largest impact on functional recovery. Muscle strength may be related to functional ability and may contribute more to loss of functional ability than impaired dexterity, muscle tone sensation or pain.[3] One promising upper extremity motor recovery intervention is task-oriented training (TOT).[4] TOT is a behavioral approach in which the therapist focuses on the tasks that need to be performed in order to meet certain goals, or to achieve a certain performance standard. Task-oriented training is aimed to improve control strategy by difficulties through various measures. During TOT some stroke subjects does various movement and learn to reduce inappropriate movements, improving and learn to increase their functional ability.[5] It has been used to facilitate improvements in neuromuscular and musculoskeletal system and has been reported that TOT can result in improvements of the task performance.[6] However, most existing studies relating to TOT for stroke subjects focus on trunk control and balance ability. Research on changes in upper extremity function and activities of daily living in stroke subjects is lacking.[7]

A meta-analysis of clinical trials evaluating TOT has reported modest benefits in functional outcomes for lower limb motor, but not for

upper limb impairments.[4] The studies included in the meta-analysis were small, heterogeneous in terms of population and outcome, and some used active comparators that may have also used task practice. [4] Studies on stroke population have shown that task-oriented training improves locomotion and lower limb weight bearing in sitting and standing up.[6] The TOT is one of the moderate-quality evidenced based interventions for promoting beneficial neuroplasticity associated with paretic UE functional performance.[8] Furthermore, a recent study involving serial positron emission tomography found that TOT induces brain plasticity in stroke subjects. In addition to findings from training studies, reaching with the impaired limb improved when familiar objects are used every day and functional goals are emphasized during a testing session.[6]

Muscle weakness is recognized as a limiting factor in the recovery of stroke subjects. Progressive resistance training (PRE) is one of the therapy for treatment of stroke subjects.[9] PRE refers to progressive increases in resistance to a muscle as training induces greater ability to produce and sustain force.[5] The key elements of PRE are to provide sufficient load (resistance) so that only a relatively small number of consecutive repetitions (usually less than 12) can be completed before fatigue, to progressively increase the amount of resistance as strength increases, and, to continue the programme for a sufficient duration (minimum 4 weeks) for benefits to accrue. PRE has been used successfully to restore function in older adults with chronic disease and frailty.[6] The early stroke rehabilitation literature raised concerns that resistance training might adversely affect movement performance by increasing spasticity.[9] The underlying mechanism of neuromuscular weakness after stroke possibly include atrophy of type II fibers, loss of motor units, collateral re innervations and altered firing of motor unit groups.[9]Bourbonnais and Giuliani have found the changes after stroke which include denervation potentials, loss of motor units, and selective atrophy of type II muscle fibers, impaired motor unit recruitment, and decreased maximal contractions.[10]The overall contraction time has been found to be prolonged, and some studies have shown a decrease in the motor unit firing rate. All of these factors can contribute to muscle weakness.[11]The resulting weakness may impair movement production and control which leads to limitations in goal oriented activities, independence in everyday living and work capacity. As substantial remodeling of motor units may occur between 2 and 6 months after stroke.[12]

Recovery of upper limb function involves three phases: firstly; activation of cell repairs, secondly; functional cell plasticity and finally; neuro anatomical plasticity. An effective rehabilitation allows most subjects to regain enough movement and control of their limbs to perform their activities of daily living.[13] It might be possible to influence this process with therapies directed towards increasing muscle strength and thus motor function.[10] One objective of rehabilitation after stroke is to maximize the subject's independence in gross motor skills and walking and thus improve his/her ADLs.[14] Previous literature was found for stroke rehabilitation on upper extremity functions which was based on research on muscle weakness, the correlation of muscle strength with function, and the studies on the effects of strength training suggest that strengthening exercises may improve functional outcomes.[15]

A systematic review of muscle strength training after stroke has found positive effects on both strength and functional activity. However, improvement in functional activity may not be possible without required strength to perform any task.[16] Preliminary evidence suggests that upper limb task– orientated progressive resistance strength training may be effective and it is well established in clinical practice within stroke units that are known to enhance recovery.[17] Flansbjer et al 2012 showed that there is a long term benefit of progressive resistance exercise (PRE) in chronic stroke.[18] This implies that progressive resistance training could be an effective training method to improve and maintain muscle strengthening long term perspective.[19] Felipe Jose Aidar et al 2012 have also found that strength training may provide an improvement in trait and state anxiety.[20] So, RT may improve or reduce fatigue, incidence of fall and fractures, reducing disability and improving independence. Overall, RT improves quality of life and mood. A meta-analysis done by Ming-de Chen et al (2011) has shown the moderate support for the use of exercise to improve Health related quality of life (HRQOL) in stroke survivor however effective strategies could not be identified so, further studies were suggested.[21]

Several studies has suggested there is a need for high quality RCT to prove effectiveness of TOT and compare with other conventionally applied or newly developed and effective therapies. So, the primary aim of this study was to compare the effect of TOT and PRE on upper extremity hand motor recovery, dexterity and motor functioning in sub-acute stroke subjects. The secondary aim was to find quality of life of subjects after TOT and PRE and also to know which better treatment technique for rehabilitation.

Materials and Method : Study population : Stroke subjects were recruited from Central Referral Hospital in Sikkim, India by simple random sampling method. SMIMS Institutional ethics committee approved the study on 3rd May 2016 with IEC registration number IEC/408/16-016. This study was not register for clinical trial registry in INDIA. Stroke was defined as an acute event of cerebrovascular origin causing focal or global neurologic dysfunction lasting more than 24 hours, as diagnosed by a neurologist and confirmed by computed tomography or magnetic resonance imaging. Subjects were included in the study if they (1) had a first episode of unilateral stroke with hemiparesis from 14 to 90 days (2) had a Brunnstrom score between stages II and III for the upper extremity, (3) Both gender of 30-70 years of age, (4) Mini-Mental State Examination score (MMSE) ≥ to 24 (21 for illiterate). (5) Able to sit independently for 30 minutes. We also applied the following exclusion criteria: Subjects with severe aphasia, severe shoulder pain affecting therapy or any comorbid condition that could limit upper extremity function, visual or hearing impairment.

Recruitment and randomization: We used a randomized controlled design in which the assessor was blinded to the group allocation of each subject. All assessments were performed by the same investigator who was blinded to the treatment assignment. The baseline data regarding name, age, sex, hospital number, post stroke duration, the side of involvement, MMSE and brunnstorm recovery stage was taken after informed consent for all subjects. Subjects were individually randomized into TOT with conventional therapy (CT) and PRE with CT groups by using computer generated random numbers (fig.1). Blocks were numbered, after which we used a random-number generator program to select numbers that established the sequence in which blocks were allocated to one or the other group. A physical therapist who was blinded to the research protocol and was not otherwise involved in the trial conducted the random-number program. There was total number of 43 subjects out of which 22 were in TOT group and 21 were in PRE group. Both the TOT group and PRE group received the CT programs for thirty minutes additionally and had each of their own therapies for thirty minutes per session, five days a week for three weeks. The CT was subject-specific and consists of Rood's facilitation techniques, Bobath techniques and Motor relearning program.

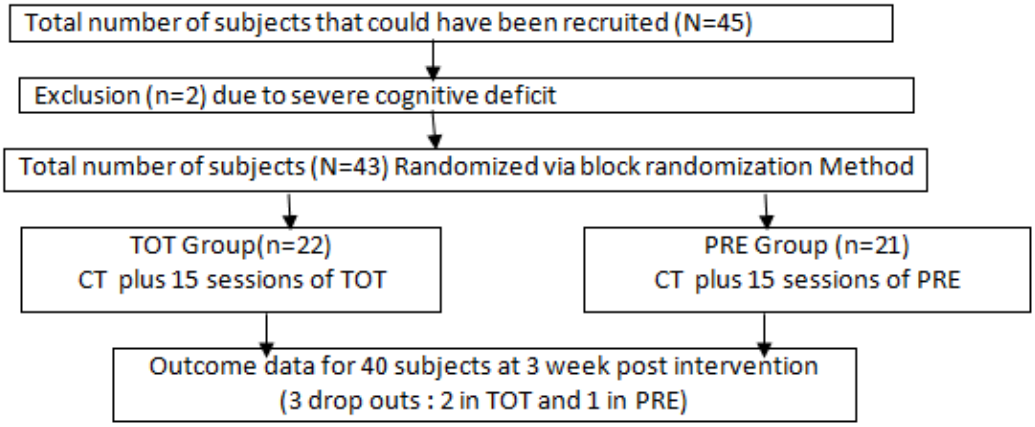
Intervention and conventional therapy group : TOT group i.e. group A subjects made to sit on a chair, feet were firmly positioned on the floor, the trunk was erect and positioned against the chair back. All subjects received individually tailored TOT program for affected upper extremity (UE) in the morning time. All subjects performed warm-up, exercise for 10 minutes; they then practiced the selected functional tasks for 30 minutes. During these 30 minutes TOT, a 2 -minute rest period followed every 10 minutes of continuous practice. In the TOT program, each participant practiced 3 out of 6 selected functional tasks according to his/her preference. Selected tasks were drinking water from a glass, lifting a glass of water to a level of 90° shoulder flexion with an extended elbow, stacking paper cups one over another, wiping the table with a towel with the elbow extended, grasping and releasing a 6 cm in diameter tennis ball, and eating with spoon.Variables such as speed, distance, or/and resistance progressively increased in difficulty according to the individual's ability. The physical therapist provided verbal, visual, or proprioceptive feedback and manually assisted the subjects to ensure they performed the tasks completely and precisely. The TOT program was based on the principles of 'use it and improve it,' 'specificity,' 'repetition,' 'salience,' and 'intensity'.[22]

PRE group i.e. group B subjects made to sit on a chair, feet were firmly positioned on the floor, the trunk was erect and positioned against the chair back. All subjects received individually tailored PRE for affected upper extremity (UE) in the morning time which was started after evaluation of individual one- repetition maximum (1-RM). It is the maximum resistance muscle can contract against to produce an adequate range of motion for a repetition to be considered

complete.[23] Prior to PRE warm up was given for 10 minutes for all subjects who was followed by resistance exercise of 3 sets of 8 repetitions of each 4 exercises with 2 minute rest in between sets. There were four strengthening exercises focus on shoulder flexion (SF), Elbow flexion (EF) , Elbow extension (EE) and wrist Extension(WE) for affected UE with weight cuff (1/2 kg or 1kg) which was according to 1-RM of subjects. These musculatures were targeted because extending as well as flexing of these muscles (shoulder, elbow and wrist) against gravity is functionally relevant in many goal directed movements and is an important component for motor retraining therapies following stroke.

All subjects initially started with low intensity i.e. 50% of (1-RM) in firs week and moderate intensity i.e. 70% of (1-RM) for next 2 weeks. Duration of PRE was 30 minute /session for weekly frequency as 5 days /week for 3 weeks. Pattern of muscle contraction used was concentric muscle contraction for shoulder, elbow and wrist. The initial volume (i.e. repetitions /sets) and intensity (i.e. resistance) of RT were selected based on a previous study that elicited the cross education effect and corticospinal adaptations to an axial muscle of the UE.[24] Progression was made over a period of 15 sessions by reducing the speed, changing the weight and adding more sets to the individual. Thus the training load varied across subjects and was contingent upon the ability to progress over the course of PRE. Training load was calculated by multiplying the total no of repetitions performed in each session by the respective percent of 1-RM training, intensity, then summing the resulting value across all 15 sessions.

Fig 1: Flow diagram for randomized subject assignment in this study



Outcome measures : To measure improvement in motor recovery of UE the Action research arm test (ARAT), for motor functioning Fugl‑Meyer assessment (FMA) and Modified Barthel Index (MBI), for gross manual dexterity Box and Block test (BBT) was administered. HRQoL was also assessed by Stroke Specific Quality of life (SS-QOL) questionnaire. The ARAT, FMA, and BBT was administered as primary outcome whereas MBI and SS-QOL as secondary outcome. Outcome measures were performed at 0 months (pretreatment) and at 3 weeks (posttreatment).

The ARAT is a standardized ordinal scale that measures UE (arm and hand) function. It is a 19-item measure divided into 4 basic movements: grasp, grip, pinch, and gross movements of extension and flexion at the elbow and shoulder which assesses the ability to handle smaller and larger objects with a variety of qualitatively rated items. It is reliable and valid measure to assess upper limb functions in stroke subjects.[25] The FMA is 3 point ordinal scale to measure impairments of volitional movements. Its motor score includes 33 items related to movements of the proximal and distal parts of the upper extremity. The total score ranges from 0 to 66. It has good validity and high reliability. It is having 4 components: shoulder/elbow/wrist, wrist, hand and co-ordination/speed.[26] The BBT was devised to assess unilateral gross manual dexterity in stroke subjects. It requests subjects to seat at a table, facing a rectangular box that is divided into two square compartments of equal dimension by means of a partition: one of the two compartments contains one hundred and fifty, 2.5 cm, coloured, wooden cubes. The individual is instructed to move as many blocks as possible, one at a time, from one compartment to the other for a period of 60 seconds. The final score

is computed by counting the number of blocks moved during the one-minute trial period. The interrater reliability and validity of BBT are excellent.[27]

The MBI is a well-validated tool for the assessment of selfcare and mobility skills in stroke which assess feeding, dressing, personal hygiene, bathing, toileting, bladder and bowel control, transfers, ambulation, and stair climbing. Each category of the MBI is rated on a scale of one to five, with one indicating inability to perform the task and five, full independence.[28]

The SS-QOL was developed using standard psychometric techniques from interviews with stroke survivors, and it includes 49 items encompassing 12 domains: energy, family roles, language, mobility, mood, personality, selfcare, social roles, thinking, vision, upper extremity function, and work/productivity. Each item is ranked on a 5-point Likert scale, with higher scores indicating better function. [29]

Statistical analysis : The data was statistically analyzed using SPSS 22.0 version. All statistical analysis was performed on the final 40 subjects because 2 drop outs were in TOT group and 1 was in PRE group. 2 subjects stopped coming for exercise at 2nd week of intervention and 1 subject discontinued due to ill health at 3rd week. The mean and standard deviation of the data were obtained through descriptive statistics. Data were normally distributed. Post hoc analysis with Bon- Feronni test was used to see the changes in the group and between the groups. The main effect and interaction effect i.e. F value was computed with level of significance fixed at <0.05 (P<0.05).

Results : Demographic and clinical characteristics of the 40 subjects, as well as baseline comparisons of the groups, are presented in table 1. Baseline comparisons revealed that age, sex, duration, type, side of involvement, MMSE scores did not differ between the groups. At baseline subjects of both groups showed no significant differences regarding ARAT, FMA, BBT, MBI and SS-QOL scores (Table 2 and 3). Data given in the Table 2 shows the changes in variables from pre to post intervention in RT group. After 3 weeks of intervention, subjects of both groups showed statistically significant improvements in all the variables measured (Table 2 and 3). No relevant adverse event was noted during the study in both groups. Table 4 presents the between-group comparisons of the change score for ARAT, FMA, BBT, MBI and SS-QOL from baseline to post intervention. ANOVA test was performed to analyse the change within resistance group.

Table 1: Demographic Characteristics of the Mirror and Control Groups and Baseline Measurements

VARIABLES	TOT with CT (GROUP A)	PRE with CT (GROUP B)
Age	54.0 ± 13.1	51.0 ± 12.7
Sex (Male : Female)	13 : 7	15:5
Side Of Involvement (Right : Left)	14:6	12:8
Duration (In Days)	18.2 ± 4.1	16.3 ± 4.8
Mmse	23.4 ± 1.3	22.5 ± 1.5
Brunnstorm recovery stage 2 and 3(2:3)	16:4	17:3

Values are number or mean ± standard deviation, ranges provided for continuous variable; MMSE: Mini-mental state examination; TOT: Task Oriented training; PRE: Progressive Resistance Exercise; CT: Conventional training

Table 2: Motor Recovery, Motor Functioning and Quality of life Scores of stroke subjects at Pre and Post intervention in TOT group.

Group A- TOT					
Variables	Pre intervention	95% CI	Post intervention	95% CI	P value
ARAT	24.95 ± 5.4	24 – 32.5	38.85 ± 6.02	35.5 – 44	0.001
FMA	72.20 ± 10.91	64 – 80.5	97.1 ± 14.41	86.25-101.5	0.001
BBT	15.6 ± 8.48	10 – 18	27.5 ± 6.11	23 – 30.50	0.001
MBI	43.50 ± 16.06	30- 56.25	75.75 ± 9.49	68.75 - 85	0.001
SSQOL	79.65 ± 10.36	68.75 – 92.5	98.60 ± 10.36	91.75 - 104	0.001

Table 3: Motor Recovery, Motor Functioning and Quality of life Scores of stroke subjects at Pre and Post intervention in PRE group

Group B -PRE					
Variables	Pre intervention	95% CI	Post Intervention	95% CI	P value

ARAT	30.5 ± 5.14	26 – 32.25	34.95 ± 6.32	30.75 - 38	0.001
FMA	68.65 ± 12.00	63.25 – 72.25	80.7 ± 9.53	73.5 - 86	0.001
BBT	15.7 ± 6.12	11.75 – 17.25	20.0 ± 6.34	16 – 21.5	0.001
MBI	48.25 ± 11.27	45 – 55	66.25 ± 12.65	63.75 – 71.25	0.001
SSQOL	70.85 ± 7.51	66.75 – 78	85.45 ± 9.90	80 – 89.25	0.001

Table 4: Between-Group differences in change Scores for outcome measures

Variable	TOT (Mean difference)	PRE (Mean difference)	P value	F value
ARAT	13.9	4.45	< 0.05	191.5
FMA	24.9	12.05	< 0.05	37.25
BBT	11.9	4.3	< 0.05	93.2
MBI	32.25	18.1	< 0.05	77.5
SSQOL	19.1	14.6	<0.05	31.77

Discussion: The present study demonstrated that 3 weeks of TOT and PRE can safely improve the motor recovery, hand and finger dexterity, functional status and quality of life in sub- acute stroke subjects. The result has shown more significant improvement in ARAT, FMA, BBT, MBI and SS-QOL in TOT group compared to PRE group. Greater improvement in TOT group can be explained by the following mechanism: the motor or functional recovery of TOT is because of enhanced neural plasticity and cortical reorganization of the learned function in the damaged surrounding cortex and even in the opposite hemisphere.[8] A study reports that human brain responds to training through its special ability called neural plasticity which is the ability of the neural circuit to undergo change in function or organization due to previous activity and change in response to environmental cues, experience, injury or disease.[4] Significant improvement was noted in all variables like ARAT, FMA, BBT MBI and SSQOL. The findings are based on the previous study done by Chanuk Yoo where author found improvement in similar variables and suggested that upper extremity functions and activities of daily living in stroke subjects can be improved significantly byTOT.[5]

TOT has significantly improve the upper limb function in this study which is based on the hypothesis that TOT can induce neural plasticity in affected cerebral hemisphere by using the affected upper extremity in functional task. These is supported by the study conducted by Jannette Blennerhassett et al in which they found significant improvement in the upper arm item of the MAS and the JTHFT after 3 weeks of TOT. Further they suggested that 3 weeks of upper extremity TOT can have significant improvement in upper extremity function and quality of life in stroke subjects.[30]

The present study supports the beneficial effect of TOT in upper extremity motor recovery and function in stroke subjects. These findings are in accordance with the systematic review done by Jackie Bosch et al where they supported the potentially beneficial effects of task oriented training practice in upper extremity motor recovery and improvement in activities of daily living and quality of life. The result of this review does provide the evidence of a possible effect of TOT which can induce cortical reorganization and improve motor function and overcome learned nonuse of the affected upper extremity.[31] In this study there is significant improvement in SSQOL in stroke subjects in more in TOT group. These findings are in line with the findings of the systematic review done by Ming-De Chen et al in which they provided new evidence that exercise training has small to medium statistical significant positive effect in improving HRQOL in stroke subjects.[32]

The improvement was also observed in PRE group which can be explained by the following mechanism. The strength gain are likely to be mediated by both improvement in neural activation and muscular structure and function.[33] Gabriel DA has found that an increase in neural drive is due to increase in the magnitude of efferent neural output from the CNS to activate muscle fibers.[34] Muscle structure and functions has been explained by the training that can result in improvement in the ability to generate force in individual with stroke by increase in the recruitment of motor unit.[33] Motor unit are also capable of increasing their discharge rate with strength training. Strength training has potential

to alter passive viscoelastic properties of muscle and tendon.[35]

In this study we found that improvement in the outcome measures has significant change in PRE group for upper extremity function which was assessed by FMA, ARAT and BBT. These findings are in lined with the previous studies done by Yaa ra yang et al where they examined the effect of PRE in stroke subjects and they found that strengthening can be accomplished using PRE programme. They suggested that PRE can improve muscle strength and that could be an important factor in improvement of functional abilities after stroke.[36] These findings are also in line with the previous study done by Hen et al in which stroke subjects were randomly divided into three groups and motor function were assessed using FMA, ARAT, and Barthel index. They showed improvement in all variables however greater improvement was observed in FMA component.[37]Susan L morris et al also reported in a systematic review that PRE has significant effect on the ability to perform upper limb activities which occur at shoulder elbow and hand. The results demonstrated significant changes on the FMA upper limb assessment and the BBT.[38]These findings are in accord with the present study.

Some studies investigating strength training after chronic stroke has also predicted a gain at the participatory level and in HRQoL. Meta-analysis done by Ming de Chen et al (2012) has also found the improvement in HRQoL with exercise in chronic stroke subjects.[32] One small trial by Kim (2001) on 20 stroke subjects did not show any significant differences between the RT group and the control group in either the physical or mental health component of the SF-36 at the end of intervention.[39] Most of the previous literature has used SF-36 questionnaire to predict HRQoL in stroke subjects whereas present study used more specific outcome measure i.e. SS-QOL to predict HRQoL in stroke subjects and found improvement in HRQoL after RT. As compared to other component of SS-QOL such as self care, upper extremity function, energy, mood, personality and work/productivity have more improvement after 8 weeks of intervention. The improvement in SS-QOL can be due to improvement in the hand and limb function resulting from improved muscle strength. Overall there was better improvement in TOT group in all variables compared to PRE group on upper extremity function and quality of life in stroke subjects after 3 weeks of intervention.

Study limitations : A potential limitation of this study is the generalizability of the results that these findings may not be applicable to chronic stroke subjects with severe cognitive deficits. Another limitation could be muscle tone which was not assessed and it is an important component because any activity/intervention that involves attempted repetitive effortful muscle contraction can result in increase motor unit activity and changes in spasticity after stroke. Other possible limitations could be lack of follow up at post intervention. The functional improvement of the paretic arm cannot be explained from cortical activation patterns. Therefore, further studies using non-invasive brain imaging technology should be conducted to observe the cortical reorganization corresponding to improved paretic UE function after TOT in subacute stroke subjects. Future studies may also investigate the effectiveness of TOT on other impairments like apraxia, neglect etc and also follow up subjects to know its long term effect. Lastly, it should also be compared with other stroke rehabilitation technique.

Conclusion: In conclusion, this study found impressive positive effects of TOT compared with PRE on motor recovery, especially manual dexterity, grasping performance, functional transfer ability as well as gross motor recoveries; motor functioning and quality of life in stroke subjects. This study is important to help to inform the health professionals about the TOT in treatment for sub acute stroke subjects. It also provides benefits on the prognosis of stroke subjects.

References

1. Ralph L. Sacco et al. An Updated Definition of Stroke for the 21st Century. A Statement for Healthcare Professionals from the American Heart Association/American Stroke Association. Stroke. 2013; 44:2064-2089.
2. Cleusa P Ferri Claudia Schoenborn, Lalit Kalra, Daisy Acosta, Mariella Guerra, Yueqin Huang,K S Jacob et al. Prevalence of stroke and related burden among older people living in Latin America, India and China. J Neurol Neurosurg Psychiatry 2011; 82:1074-1082.
3. Catherine Donaldson, Raymond Tallis, FmedSci, Simon Miller, Alan Sunderland,

Roger Lemon, and Valerie Pomeroy. Effects of Conventional Physical Therapy and Functional Strength Training on Upper Limb Motor Recovery after Stroke: A Randomized Phase II Study. Neurorehabil Neural Repair. 2009 May; 23(4):389-97.

4. Gui Bin Song. The effect of task-oriented versus repetitive bilateral arm training on upper limb function and activities of daily living in stroke patients. J. phys. Ther,sci, 2015;27:1353-1355.
5. Chanuk Yoo et al, Impact of task -oriented training on hand function and activities of daily living after stroke. J. Phys .Ther. Sci 2015; 27: 2529-2531.
6. Gergory T. Thielman et al, Rehabilitation of Reaching After Stroke: Task-Related Training Versus Progressive Resistive Exercise Arch Phys Med Rehabil 2004;85:1613-8.
7. Flansbjer, Ulla-Britt; Lexell, Jan Brogårdh, Christina. Long-Term Benefits of Progressive Resistance Training in Chronic Stroke: A 4-year Follow-Up. : Journal of Rehabilitation Medicine, 44(3), March 2012;.218-221.
8. Pollock A, Farmer SE, Brady MC, et al.: Interventions for improving upper limb function after stroke. Cochrane Database Syst Rev, 2014, (11): CD010820.
9. Catherine Donaldson, Raymond Tallis, FmedSci, Simon Miller, Alan Sunderland, Roger Lemon, and Valerie Pomeroy. Effects of Conventional Physical Therapy and Functional Strength Training on Upper Limb Motor Recovery after Stroke: A Randomized Phase II Study. Neurorehabil Neural Repair. 2009 May;23(4):389-97.
10. Gemperline JJ, Allen S, Walk D, et al. Characteristics of motor unit discharge in subjects with hemi paresis. Muscle Nerve. 1995;18(10):1101–14.
11. Bourbonnais, D, Vanden Noven, S. Weakness in patients with hemiparesis. *American Journal of Occupational Therapy.* 1989;43:313–319.
12. Hara Y, Masakado Y, Chino N. The physiological functional loss of single thenar motor units in the stroke patients: when does it occur? Does it progress? Clinical Neurophysiology. 2004; 115 (1):97–103.
13. Langhorne P, Coupar F, Pollock A. Motor recovery after stroke: a systematic review. Lancet Neurology 2009;8(8): 741–54.
14. Morrissey, MC, Harman, EA, Johnson, MJ. Resistance training modes: specificity and effectiveness. *Med Sci Sports Exerc*. 1995;27:648–660.
15. Hankey GJ, Warlow CP. Treatment and second ary prevention of stroke: evidence, costs, and effects on individuals and populations. Lancet 1999; 354: 457-1463.
16. Linda S. Williams, Morris Weinberger, Lisa E. Harris, Daniel O. Clark and José Biller. Development of a Stroke-Specific Quality of Life Scale. Stroke. 1999;30: 1362-1369.
17. Saunders DH, Greig CA, Mead GE, Young A. Physical fitness training for stroke subjects. Cochrane Database of Systematic Reviews 2009, Issue 4. Art. No.: CD003316.
18. Flansbjer, Ulla-Britt; Lexell, Jan Brogårdh, Christina. Long-Term Benefits of Progressive Resistance Training in Chronic Stroke: A 4-year Follow-Up. : Journal of Rehabilitation Medicine, March 2012; 44(3), 200-206.
19. Pollock A, Farmer SE, Brady MC, Langhorne P, Mead GE, Mehrholz J, van Wijck F. Interventions for improving upper limb function after stroke. Cochrane Database of Systematic Reviews 2014, Issue 11. Art. No.: CD010820.
20. Felipe Jos´e Aidar, Ricardo Jac´o de Oliveira, Ant´onio Jos´e Silva, Dihogo Gama de Matos,Mauro L´ucio Mazini Filho, Robert C. Hickner, and Victor Machado Reis, The Influence of Resistance Exercise Training on the Levels of Anxiety in Ischemic Stroke. Stroke Research and Treatment Volume 2012, 6.
21. Ming-De Chen, MS, OT; James H. Rimmer, PhD .Effects of Exercise on Quality of Life in Stroke Survivors. A Meta-Analysis. Stroke. 2011;42: 832-837.
22. Kleim JA, Jones TA: Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. J Speech Lang Hear Res, 2008,51: S225–S239.
23. Goodwill AM, Pearce AJ, Kidgell DJ. Corticomotor plasticity following unilateral strength training. Muscle Nerve.2012; 46:384–93.
24. Kidgell DJ, Stokes MA, Pearce AJ. Strength training of one limb increases cor-ticomotor excitability projecting to the contralateral homologous limb. Motor Control. 2011; 15:247–66.
25. Nijland, Rinske; van Wegen, Erwin; Verbunt, Jeanine; van Wijk, Renske; van Kordelaar, Joost; Kwakkel, Gert A comparison of two validated tests for upper limb function after stroke: The Wolf Motor Function Test and the

Action Research Arm Test. Source: Journal of Rehabilitation Medicine, 2010; 42:7: 694-696(3).
26. Julie Sanford, Julie Moreland, Laurie R Swanson, Paul W and Carolyn gowland. Motor Performance in Subjects Following Stroke. Reliability of the Fugl-Meyer Assessment for Testing Motor Performance in Subjects Following Stroke. Phy the. 1993;73:447-454.
27. Platz T, Pinkowski C, van Wijck F, Kim I-H, di Bella P, Johnson G. Reliability and validity of arm function assessment with standardized guidelines for the Fugl-Meyer Test, Action Research Arm Test and Box and Block Test: a multicentre study. ClinRehabil. 2005;19(4):404–11.
28. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J. 1965; 14: 61-5.
29. Linda S. Williams, Morris Weinberger, Lisa E. Harris, Daniel O. Clark and José Biller. Development of a Stroke-Specific Quality of Life Scale. Stroke. 1999;30:1362-1369.
30. Jannette Blennerhasset and Wayne Dite.Additional task-related practice improves mobility and upper limb function early after stroke. A randomized control trial. Aust journal of physiotherapy.2004;50:219-224.
31. Jackie Bosch et al.Does task-oriented practice improve UE motor recovery after stroke?A Systematic review. Hindawai publishing corporation ISRN stroke.2014; 504910:10.
32. Ming-De Chen, James H. Rimmer. Effects of Exercise on Quality of life in Stroke Survivors. A Meta-Analysis.Stroke.2011;42:832-837.
33. Kamen G and CA Knight. Training related adaptation in motor unit discharge rate in young and old adults. J Gerontology.2004;59:1334-38.
34. Gabriel DA et al. Neural adaptation to resistive exercise: mechanism and recommendation for training practices.2006;36:133-49.
35. Signal NEJet al. Strength training after stroke: Rationale, evidence and potential implementation barriers for physiotherapy. New Zeland journal of physiotherapy.2011; 42:101-107.
36. Yaa-Ru Yang et al. Task oriented progressive resistance strength training improves muscle strength and functional performance in individual with Stroke. Single blinded randomized controlled trial. Journal of clinical rehabilitation.2006;20:860-70.
37. Hen et al. Repetitive training of isolated movements improves the outcome of rehabilitation of the centrally paretic hand. J Neurolsci.1995;130:59-68.
38. Susan L Morris et al. Outcome of progressive resistance strength training following Stroke. A Systematic review. Clinical Rehabilitation.2004;18:27-39.
39. Kim CM, Eng JJ, MacIntyre DL, Dawson AS. Effects of isokinetic strength training on walking in persons with stroke: a double-blind controlled pilot study. Journal of Stroke and Cerebrovascular Diseases 2001;10(6):265–73.

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