

EFFICACY OF “HIGH INTENSITY PROGRESSIVE RESISTANCE STRENGTH TRAINING” (HIPRST) VERSUS “BALANCE TRAINING” ON FALL INCIDENCE AND PHYSICAL FUNCTION IN ELDERLY PATIENTS WITH POSTOPERATIVE HIP FRACTURE

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Abstract-

BACKGROUND: Elderly people are often experiencing increased fear of fall and reduced physical function than younger people. Following a post-operative hip fracture, they experience increased fear of falls and reduced physical function such as walking, chair rising, and carrying shopping bags. These above factors will affect muscle strength, gait velocity, and balance confidence, posture, quality of life. But progressive resisted strength training and balance training exercises improves muscle strength, gait velocity, balance confidence, posture and quality of life.

METHODOLOGY: Quasi experimental (pre-post test) study conducted in the Department of Orthopedics & Orthopedic surgery, PSG hospitals, Coimbatore. 33 postoperative hip fractures patients were selected by simple random sampling method and assigned in to 3 groups, treated with HIPRST, Balance training, Conventional physiotherapy respectively. Each group received treatment duration of 40 min session / day - 5days / week for 3 weeks. Base line assessments were taken prior to the intervention. Outcome measures were analyzed pre and post intervention such as FES-I, FR test, and TUG test.

RESULTS: The mean difference of FES-I, FR test between the groups was analyzed through Paired “t”, the results shows highly significant at $p < 0.001$ and TUG test is $p < 0.05$. These results states that HIPRST, Balance Training, and Conventional Physiotherapy had effectively reduced the fall incidence and improved balance following a post operative hip fracture patients.

CONCLUSION: HIPRST and Balance Training had significant effect of improving physical function and reduced the fall incidence following post operative hip fracture patients.

Key words: post-operative hip fracture, HIPRST, Balance Training, FR test, TUG test.

INTRODUCTION

Elderly people often experience reduced physical function and increased fear of fall than younger people. Fear of fall can lead to distress and reduced quality of life, increased medication use and activity restriction, further decline in physical functioning, greater falling risk and admission to institutional care. Following a post operative hip fractures they also experience increased fear of falls and reduced physical function such as walking, chair rising, and carrying shopping bags. These above factors will affect muscle strength, posture, balance confidence, gait velocity and quality of life. But progressive resisted strength training and balance training exercises are induces the improvement of muscle strength, posture, balance confidence, gait velocity and quality of life.

The aging process is physiological in nature and it is associated with loss of skeletal muscle mass, increased in intramuscular fat and muscle attenuation. Decline in muscle mass is caused by a general loss of muscle fibers and reduction in cross-sectional area of the surviving fibers, with the fast-twitch fibers showing accelerated muscle atrophy, especially at advanced age. Additionally, qualitative changes occur in the old muscle: specific tension (force normalized to cross-sectional area) of whole muscle and of both type I and type II muscle fibers is lower compared to a younger muscle and maximal shortening velocity is reduced.¹

These above changes make it progressively harder to carry out daily motor activities (e.g. level walking, chair rising, carrying shopping bags) due to reduced functional capacity and higher relative effort for each motor task.¹

Factors affecting the functional prognosis after hip fracture are multiple. The patients are at risk of decreased physical function. They can experience falls, fractures or new injuries results in an increased need of supportive care.³

During the first week after hip fracture surgery, there is a 50% loss of knee-extension strength in the fractured limb when compared to that of the non-fractured limb. This is mainly due to the incised TFL and Vastus lateralis muscle. This is associated with impaired physical function and mobility. Compared to patients with neck of femur fracture, trochanteric fractures are seemed to experience greater knee extension strength deficits and experience of more fracture related hip pain, which worsen the performance of functional parameters.³

With respect to recovery after a hip fracture, early mobilization and extended physical therapy including strength training implemented 6 weeks after fracture seem to promote recovery of physical function.

In theory physical therapy including progressive strength training implemented in the acute ward immediately after hip fracture surgery seems feasible.³

After hip fracture surgery, knee extension strength is important to have a proper gait mechanism with knee locking. This can prevent the fear of fall in elderly patients.

To strengthen the knee extensors, we can use isometrics to Isokinetic exercises. Progressive resistance strength training where the resistance is progressed to maintain intensity, improves strength, and functional ability and can eliminate the need for gait aids in older adults.

A meta-analysis suggests that High Intensity Progressive Resisted Strength Training (HIPRST) may improve the strength more than lower intensities of strength training, although training volume also has an important effect on the strength gains achieved. They also suggested to have research on implementing this HIPRST with particular emphasis on subgroups of older adults with chronic diseases, those who are hospitalized, and those in residential aged care and to analyze the outcomes such as falls, hospitalization, and use of health care services.⁴

The weight bearing program with balance training can also be given to these patients after hip fracture surgery. In these patients this balance training exercise produces greater improvements, particularly in balance and functional performance. Balance Training programme is superior to traditional exercise for improving function and balance.

MATERIALS AND METHODOLOGY

Populations study for the past 2 years from Jan 2013 - Dec 2014 done. Each year was 55, 53 patients. And according to the sample size calculator my study need 16 patients in each group. Patients with post operative hip fracture with early weight bearing (post operative day 3 onwards) who will be referred from the department of Orthopedics & Orthopedic surgery in PSG hospitals, Coimbatore. The samples will be selected by simple random sampling method. The patients will be allocated after obtaining the informed consent form. the subjects will be randomly assigned into 3 groups. Group A – HIPRST, Group B – Balance training, and Group C – Conventional physiotherapy All the subjects have to be undergone the assessment of FES-I, FR test, and TUG test pre and post intervention of HIPRST, Balance Training and Conventional physiotherapy. The post tests FES-I, FR Test, TUG test will be measured after 3 weeks of intervention. The treatment duration was 40 min session / day - 5days / week for 3 weeks.

INCLUSION CRITERIA

- Age 60 - 80 years
- Post operative hip fracture patients with DHS fixation and Hemiarthoplasty.
- Post operative hip fracture patients with early weight bearing program (3rd POD onwards).
- Participants with untrained in Progressive resisted strength training program.
- Participants with untrained in balance training program.
- Participants who are able to follow the instruction.

EXCLUSION CRITERIA

- Respiratory problems.
- Cardiovascular disease with restriction to strenuous exercise.
- Neurologically impaired patients.
- Renal diseases.
- Complications of the fracture (NWB or TTWB, unstable reductions, upper limb fractures.)
- Patients with psychological impairments.

INSTRUMENT & TOOL FOR DATA COLLECTION

- Fall Efficacy Scale International (FES-I)
- Functional Reach test (FR test)
- Timed up and go test (TUG test)

TREATMENT PROTOCOL

Group A - HIPRST [40 min session / day - 5days / week for 3 weeks]

WARM UP PHASE : (10 minutes)

- Deep breathing exercises - 10 times
- Ankle circles – 10 times
- Active assisted range of motion exercises to hip,knee,ankle joints.

TRAINING PHASE : (20 minutes)

HIPRST to Hip extensors, Hip abductors, Knee extensors

Protocol

Variables	
Repetition maximum, n	8 RM
Repetitions per set, n	8
Sets per session, n	2
Rest between sets, minutes	2 minutes
Session per week, n	5 sessions

COOL DOWN PHASE:**Duration :**10 minutes.

Deep breathing exercises.10 times

Ankle circles. 10 times.

Group B - BALANCE TRAINING**[40 min session / day - 5days / week for 3 weeks]****WARM UP PHASE: (10 minutes)**

- ❖ Deep breathing exercises - 10 repetitions
- ❖ Ankle circles - 10 repetitions
- ❖ Sit to stand - 10 repetitions
- ❖ Knee extension - 10 repetitions

TRAINING PHASE: (20 minutes)

Body circles : Stand with feet shoulder width apart, hands at sides. Keeping your body straight slowly sway in a circle. Continue for 1 minute

Clock reach : stand on your left leg bring your right arm to 12 o'clock. Then reach to 3, 6 o'clock.Repeat with the other side for 5 times

Staggered stance: Step forward with your right foot Maintain this position for 10 seconds. Alternate putting the other foot in front. Repeat 5 times.

Marching: Raise on one knee up as high Comfortable. Than lower raise on another Knee. Repeat 20 times.

Stepping figure 8: walk in figure of 8 pattern Repeat for 3 times.

Stepping: Side stepping over object: objects placed 12 inches apart Lift your foot at least 6 inches and side step over the objects.

Stepping: side stepping around the objects: Begin with two or more soft objects on the floor. Space them out 12 to 16 inches apart. Stand to one side of the objects. Begin by stepping forward, then to the side around the object. Facing in the same direction, step backward through the objects. Repeat this pattern to the last object.

Stepping: Over objects in line without pause between objects: Begin with two or more soft objects on the floor. Space them out 12 to 16 inches apart. Lift your foot at least 6 inches and step over the objects. Pause between each object. Then try stepping over each object without stopping.

COOL DOWN PHASE:**Duration :**10 minutes.

Deep breathing exercises.10 times

Ankle circles. 10 times

FALL EFFICACY SCALE INTERNATIONAL (FES-I)

GROUPS	MEAN	MEAN DIFFERENCE	STANDARAD DEVIATION	't' VALUE	'p' VALUE
Group A Pre test Post test	40.90901 19.7273	21.18182	1.77866	39.497	0.000
Group B Pre test Post test	37.1818 20.4545	16.72727	1.79393	30.925	0.000
Group C Pre test Post test	28.9091 20.5455	8.36364	1.43337	19.352	0.000

Table 1 shows mean difference, Standard Deviation, paired 't' value of FES-I in Group A, Group B, and Group C.

The mean difference between pre and post intervention for FES-I were 21.18182, 16.72727, 8.36364 and obtained paired 't' value were 39.497, 30.925, 19.352 respectively in all 3 groups.

The corresponding 'p' value for FES-I in all three groups were $p < 0.001$.

Therefore, the result shows that there is a statistical significance difference in post intervention value of FES-I compared to pre intervention values of all 3 groups.

TABLE 2
FUNCTIONAL REACH TEST (FR Test)

GROUPS	MEAN	MEAN DIFFERENCE	STANDARAD DEVIATION	't' VALUE	'p' VALUE
Group A					
Pre test	6.4545	5.09091	.30151	56.000	0.000
Post test	11.5455				
Group B					
Pre test	6.5455	3.81818	.60302	21.000	0.000
Post test	10.3636				
Group C					
Pre test	6.5455	2.54545	.52223	16.166	0.000
Post test	9.0909				

Table 2 shows mean difference, Standard Deviation, paired 't' value of FR test in Group A, Group B, and Group C.

The mean difference between pre and post intervention for FR test were 5.09091, 3.81818, 2.54545 and obtained paired 't' value were 56.000, 21.000, 16.166 respectively in all 3 groups.

The corresponding 'p' value for FR test in all three groups were $p < 0.001$.

Therefore, the result shows that there is a statistical significance difference in post intervention value of FR test compared to pre intervention values of all 3 groups.

TABLE 3
TIMED UP AND GO TEST

GROUPS	MEAN	MEAN DIFFERENCE	STANDARAD DEVIATION	't' VALUE	'p' VALUE
Group A					
Pre test	67.7273	22.36364	24.44697	3.034	0.013
Post test	45.3636				
Group B					
Pre test	57.8182	19.90909	24.00606	2.751	0.020
Post test	37.9091				
Group C					
Pre test	46.3636	12.63636	16.02044	2.616	0.026
Post test	33.7273				

Table 3 shows mean difference, Standard Deviation, paired 't' value of TUG test in Group A, Group B, and Group C.

The mean difference between pre and post intervention for TUG test were 22.36364, 19.90909, 12.63636 and obtained paired 't' value were 3.034, 2.571, 2.616 respectively in all 3 groups.

The corresponding 'p' value for TUG test in all three groups were $p < 0.05$.

Therefore, the result shows that there is a statistical significance difference in post intervention value of TUG test compared to pre intervention values of all 3 groups.

FALL EFFICACY SCALE INTERNATIONAL (FES-I) ONE WAY ANOVA

GROUPS	COMPARE WITH	MEAN DIFFERENCE	'p' VALUE	POST HOC ANALYSIS (TUKEY)
Group A	Group B Group C	.72727 .81818	.731 .673	19.7273
Group B	Group A Group C	.72727 .09091	.731 .995	20.4545
Group C	Group A Group B	.81818 .09091	.673 .995	20.5455

Table 4 shows mean difference, 'p' value and post hoc analysis (tukey) of FES-I in Group A, Group B, and Group C. (graph 4)

The corresponding 'p' value for FES-I in all three groups were $p > 0.05$.

Therefore, the result shows that there is no statistical significance difference in post intervention values of FES-I of all 3 groups.

FUNCTIONAL REACH TEST (FR Test) ONE WAY ANOVA

GROUPS	COMPARE WITH	MEAN DIFFERENCE	'p' VALUE	POST ANALYSIS(TUKEY) HOC
Group A	Group B Group C	1.18182* 2.45455*	0.002 0.000	11.5455
Group B	Group A Group C	1.18182* 1.27273*	0.002 0.001	10.3636
Group C	Group A Group B	2.45455* 1.27273*	0.000 0.001	9.0909

Table 5 shows mean difference, 'p' value and post hoc analysis (tukey) of FR test in Group A, Group B, and Group C. (graph 4)

The corresponding 'p' value for FR test in all three groups were $p < 0.001$.

Therefore, the result shows that there is a statistical significance difference in post intervention values of FR test of all 3 groups. And **post hoc analysis** in homogenous subsets of FR test shows HIPRST received a first, second was Balance Training, and third was Conventional physiotherapy after post intervention.

TABLE 6
TIMED UP AND GO TEST (TUG Test)
ONE WAY ANOVA

GROUPS	COMPARE WITH	MEAN DIFFERENCE	'p' VALUE	POST ANALYSIS(TUKEY) HOC
Group A	Group B Group C	7.45455 11.63636	0.657 0.367	45.3636
Group B	Group A Group C	7.45455 4.18182	0.657 0.875	37.9091
Group C	Group A Group B	11.63636 4.18182	0.367 0.875	33.7273

Table 6 shows mean difference, 'p' value and post hoc analysis (tukey) of TUG test in Group A, Group B, and Group C. (graph 4)

The corresponding 'p' value for TUG test in all three groups were $p > 0.05$.

Therefore, the result shows that there is no statistical significance difference in post intervention values of TUG test of all 3 groups.

SUMMARY AND CONCLUSION

With reference to the statistical analysis and interpretation done for data collected by FR test, it was concluded that HIPRST was more effective than Balance Training in improving physical function following a post operative hip fracture patients. Therefore from the literature review available and the statistical analysis of the data obtained my study recommends that; **"HIPRST and Balance Training had significant effect on improving physical function and reduction in fall incidence following post operative hip fracture patients"**.

"HIPRST group had superior effect on improving physical function than Balance Training and Conventional physiotherapy following a post operative hip fracture patients".

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