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Effect of Power Training on Quality of Life in Chronic Stroke Survivors

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ABSTRACT

Background: Power training is a concept where power can be best improved with the help of resistance exercise, that is, equivalent to 60% of 1RM. Along with this resistance, the exercise is to be done with maximum speed, that is, as fast as possible, which is equivalent to 33–60% of the maximum movement velocity without resistance. Power training is used for lower motor neuron lesion; but to work more on weakness for chronic stroke individuals and to improve their quality of life (QOL), power training is used for chronic stroke, that is, upper motor neuron lesion. **Objectives:** The objective was to assess the effect of power training along with conventional treatment protocol on QOL in chronic stroke survivors. **Materials and Methods:** A comparative study was carried out using convenient sampling technique during 3 months in Krishna Hospital. A total of 40 patients were subjected Group A (20 subjects) who received conventional treatment protocol and Group B (20 subjects) who underwent power training along with conventional treatment protocol. Protocol was conducted for 3 days per week (alternate days) for 6 weeks. Pre- and post-test results were assessed using Stroke-Specific QOL Scale and Modified Barthel's Index as outcome measures. **Results:** Significant, very significant, and extremely significant correlations were observed for combination of power training and conventional treatment protocol when compared to conventional treatment alone. **Conclusion:** This study concluded that the combination of conventional treatment protocol and power training for chronic stroke survivors improved their QOL.

Keywords: Chronic stroke, Power training, Quality of life

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Introduction

Long-term disability is seen for stroke survivors, the percentage for disability for stroke is nearly 15–30%.[1] A significant impact of quality of life (QOL), productivity, and independence seen in stroke survivors.[2] Diminished signal transmission along descending neural pathways causes a loss in voluntary activation which results in primary weakness post-stroke.[3-5] Disturbances during locomotion contribute to approximately 65% of individuals with stroke who are unable to ambulate independently and efficiently around the communities and their homes because of post-stroke weakness.[6-8] Slow walking speed was seen as a frequent locomotor impairment following stroke.[9] During rehabilitation for post-stroke individuals, the most often stated goal is to improve gait and gait-related activities.[10-12] Certain intervention approaches which include aerobic exercise training,[13,14] functional electrical stimulation,[15] treadmill walking with or without body weight support,[16-18] biofeedback therapy,[19] and progressive strength training[20,21] were designed to improve post-stroke walking. Across widely used rehabilitation modalities, there was found no differences in post-treatment self-selected walking speed (SSWS), under a critical review of post-stroke walking rehabilitation.[22] The heterogeneity and various deficits seen among post stroke population, likely contribute to the post stroke walking dysfunction which is reflected due to lack of superiority among intervention approaches.[9] Thus, we need to venture out on what factors whether a given individual will or will not respond to a given intervention.[9]

Power training is a concept where power can be best improved with the help of resistance exercise, that is, equivalent to 60% of 1RM. Along with this resistance, the exercise is to be done with maximum speed, that is, as fast as possible,[23] which is equivalent to 33–60% of the maximum movement velocity without resistance.[24] Power training is used for lower motor neuron lesion;[25] but to work more on weakness for chronic stroke individuals and to improve their QOL, power training is used for chronic stroke, that is, upper motor neuron lesion.[9] The purpose of the initial study was to examine the effects of Post-stroke Optimization of Walking Using Explosive Resistance (POWER) training, a high-intensity and high-velocity lower limb power training program, on post-stroke muscular and locomotor function.[20,26] Power training is a concept used for chronic stroke survivors (more than 6 months) with structural and functional impairments wherein there is a use of reciprocal inhibition, for example, weakness of biceps and spasticity of triceps, so we can work more on weakness of biceps for chronic stroke survivors. To better understand, this study aims to determine the effect of a 6-week power training protocol for chronic stroke survivors and its effect on QOL. The program focuses on two groups where one group undergoes conventional treatment for chronic stroke survivors whereas other focuses on power training along with the conventional treatment. Specifically, the purpose of this paper was to determine QOL using Stroke-Specific QOL questionnaire

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and functional mobility using Modified Barthel's Index along with power training for chronic stroke survivors.

Materials and Methods

An ethical clearance was taken from the Institutional Ethics Committee of KIMSDU, Karad, before initiation of the study. After that, concerning subjects with chronic stroke were approached. The purpose of the study was explained and written consent was taken from the subjects willing to participate. Subjects were selected for the study according to the selection criteria. Inclusion criteria were chronic stroke individuals involving both the sexes with voluntary control grading more than 1. Exclusion criteria were recurrent stroke, transient ischemic attack. Included participants were divided into two groups by convenient sampling method. After inclusion, the procedure was explained. Before initiation of exercises, Stroke-Specific QOL Scale (SSQOL) and Modified Barthel's Index were taken. Group A was conventional group and Group B was experimental group. Group A received stretching, active-assisted range of motion exercises, catch/release the ball, water task, feeding, dressing/laundry, peck board, and wrist mover. Group B received exercises such as stretching and active-assisted range of motion exercises with any two activities from Group A as per the convenience and for power training therapeutic gymnasium was used with the help of bicycle, leg press, wrist mover/supinator- pronator, and other activities such as double limb jump, calf raises, and sit to stand. Subjects received treatment for 6 weeks, alternate days/week. Pre- and post-assessment was done using Modified Barthel's Index and SSQOL Questionnaire. These measures were taken before the treatment and 6 weeks of the treatment. The effect of the treatment given to each group was noted immediately using outcome measures.

Results

Statistical Analysis

The outcome measures were assessed at the baseline before the treatment and 6 weeks after the treatment. The statistical analysis was done using paired t-test, non-parametric test, and Wilcoxon matched pairs test.

Considering SSQOL Scale as outcome measure, Figure 1 shows Group A pre- and post-test results for energy component which is considered very significant with two tailed ($P = 0.0078$) with mean ± standard deviation (SD) (2.640 ± 1.398) for pre-test and (3.045 ± 1.077) for post-test. Figure 2 shows Group A pre- and post-test results for family roles component which is considered not significant with two tailed ($P = 0.2500$) with mean ± SD (3.81 ± 0.6406) for pre-test and (3.935 ± 0.4614) for post-test. Figure 3 shows Group A pre- and post-test results for language component which is considered not significant with two tailed ($P = 0.0625$) with mean ± SD (1.97 ± 1.161) for pre-test and (2.21 ± 1.061) for post-test. Figure 4 shows Group A pre- and post-test results for mobility component which is considered not significant with two tailed ($P = 0.0781$) with mean ± SD (2.665 ± 1.254) for pre-test and (2.845 ± 1.105) for post-test. Figure 5 shows Group A pre- and post-test results for mood component which is considered not significant with two tailed ($P = 0.9892$) with mean ± SD (3.77 ± 1.033) for pre-test and (3.77 ± 1.033) for post-test. Figure 6 shows Group A pre- and post-test results for personality component with two tailed ($P = 0.5000$) which is considered not significant with mean ± SD (3.39 ± 1.446) for pre-test and (3.49 ± 1.349) for post-test. Figure 7 shows Group A pre- and post-test results for thinking component with two tailed ($P > 0.9999$) which is considered not significant with mean ± SD (2.8 ± 0.8944) for pre-test and (2.85 ± 0.8751) for post-test. Figure 8 shows Group A pre- and post-test results for self-care component with two tailed ($P = 0.0020$) which is considered very significant with mean ± SD (2.11 ± 1.153) for pre-test and (2.62 ± 0.7811) for post-test. Figure 9 shows pre- and post-test results for social roles component with two tailed ($P = 0.0156$) which is considered significant with mean ± SD (2.18 ± 0.8408) for pre-test and (2.39 ± 0.6569) for post-test. Figure 10 shows pre- and post-test results for upper extremity function component with two tailed ($P = 0.0039$) which is considered very significant with mean ± SD (1.56 ± 0.7667) for pre-test and (2.03 ± 0.5992) for post-test. Figure 11 shows pre- and post-test results for vision component with two tailed ($P = 0.5000$) which is considered not significant with mean ± SD (3.05 ± 0.9445) for pre-test and (3.2 ± 0.8944) for post-test. Figure 12 shows pre- and post-test results for Group A

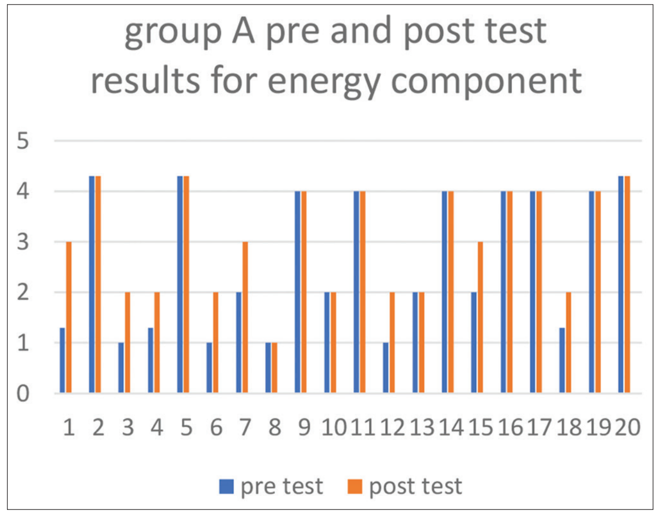

Figure 1: Stroke-Specific Quality of Life Scale results for Group A energy component

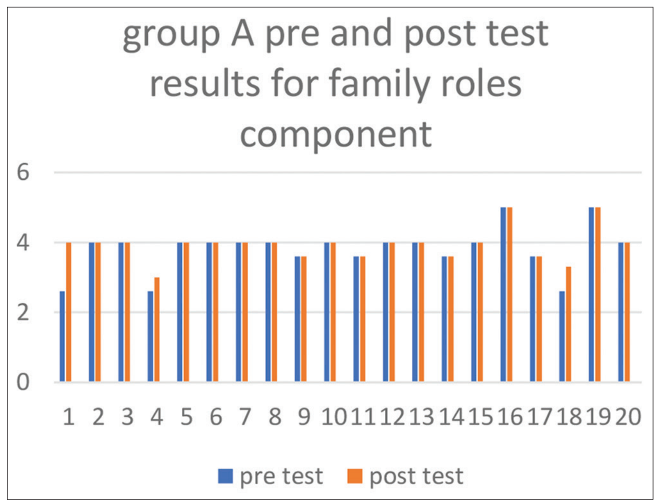

Figure 2: Stroke-Specific Quality of Life Scale results for Group A family roles component

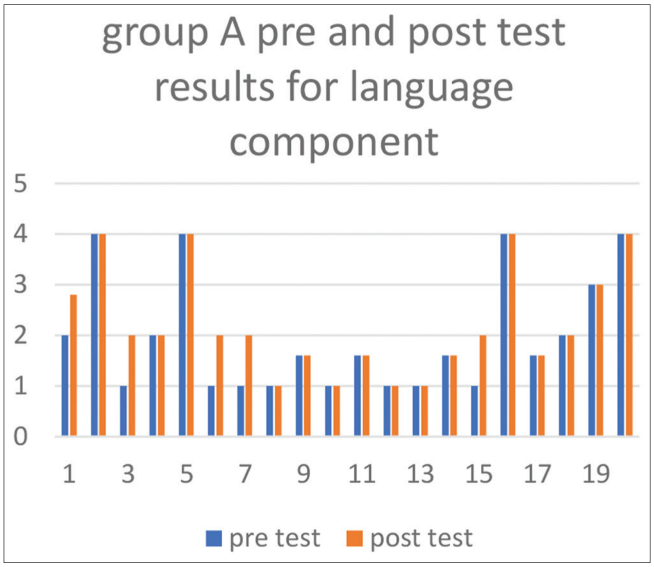

Figure 3: Stroke-Specific Quality of Life Scale results for Group A language component

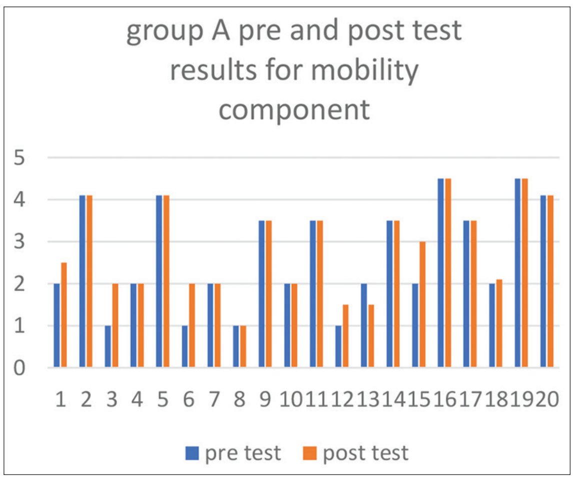

Figure 4: Stroke-Specific Quality of Life Scale results for Group A mobility component

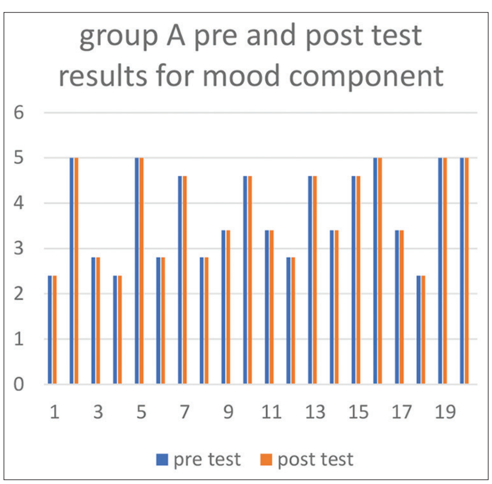

Figure 5: Stroke-Specific Quality of Life Scale results for Group A mood component

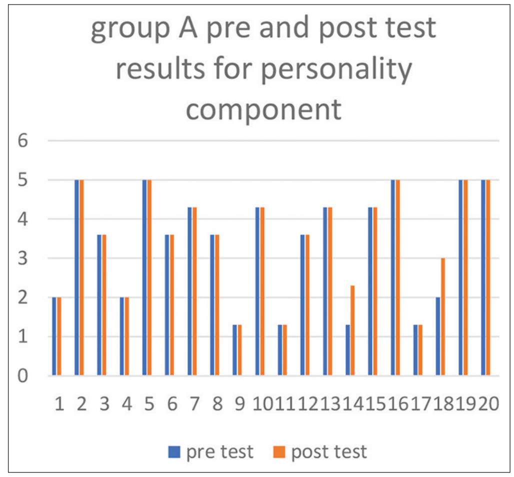

Figure 6: Stroke-Specific Quality of Life Scale results for Group A personality component

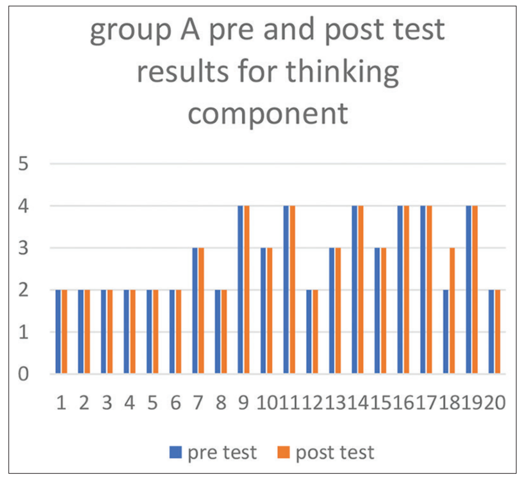

Figure 7: Stroke-Specific Quality of Life Scale results for Group A thinking component

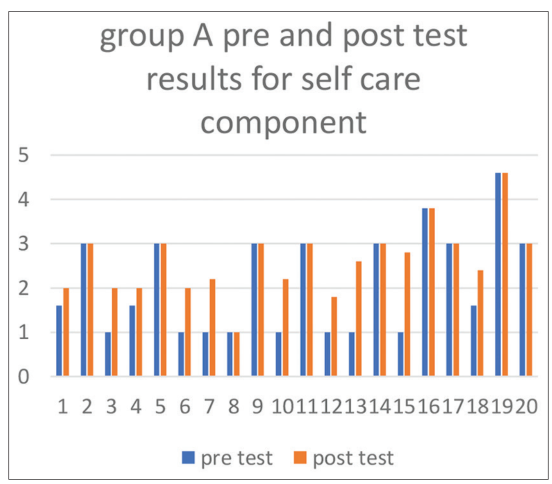

Figure 8: Stroke-Specific Quality of Life Scale results for Group A self-care component

work/productivity component with two tailed (P = 0.0313) which is considered significant with mean ± SD (1.5 ± 0.6070) for

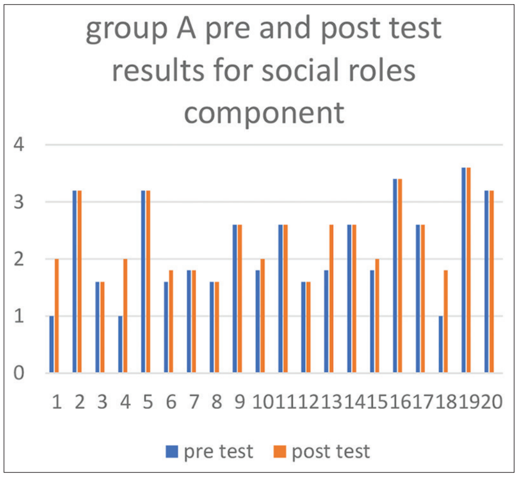

Figure 9: Stroke-Specific Quality of Life Scale results for Group A social roles component

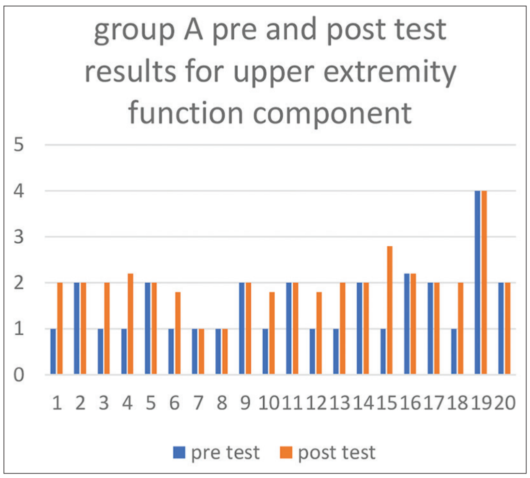

Figure 10: Stroke-Specific Quality of Life Scale results for Group A upper extremity function component

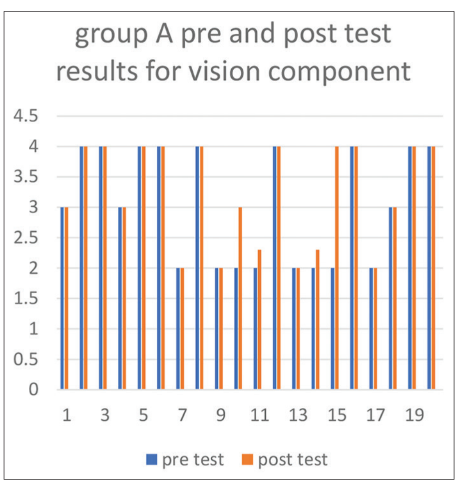

Figure 11: Stroke-Specific Quality of Life Scale results for Group A vision component

pre-test and (1.98 ± 0.7016) for post-test. Figure 13 shows pre- and post-test results for Group B energy component with two tailed

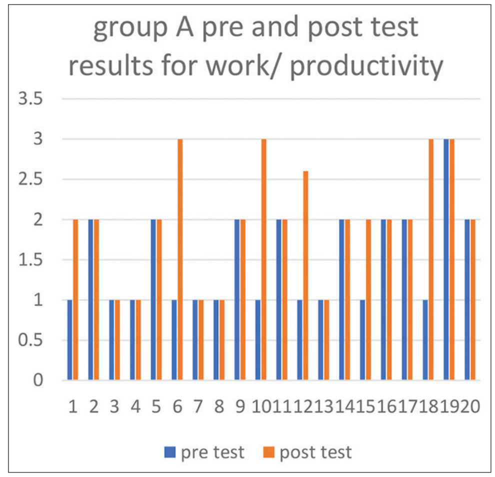

Figure 12: Stroke-Specific Quality of Life Scale results for Group A work/productivity component

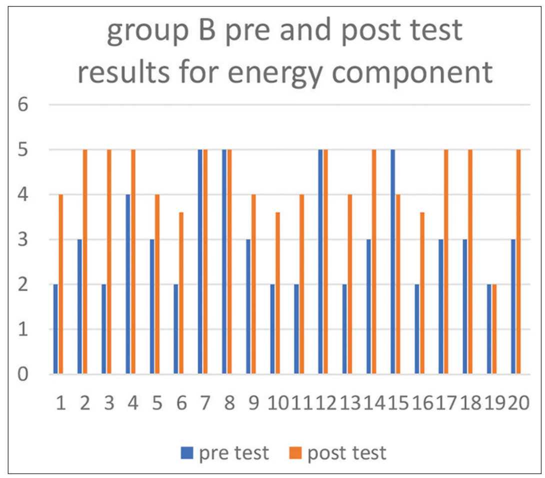

Figure 13: Stroke-Specific Quality of Life Scale results for Group B energy component

($P < 0.0001$) which is considered extremely significant with mean ± SD (3.05 ± 1.146) for pre-test and (4.34 ± 0.8003) for post-test. Figure 14 shows pre- and post-test results for Group B family roles component with two tailed ($P = 0.0020$) which is considered very significant with mean ± SD (4.64 ± 0.3761) for pre-test and (4.96 ± 0.1231) for post-test. Figure 15 shows pre- and post-test results for Group B language component with $P < 0.0001$ which is considered extremely significant with mean ± SD (2.52 ± 1.311) for pre-test and (3.99 ± 0.8789) for post-test. Figure 16 shows pre- and post-test results for Group B mobility component with $P < 0.0001$ which is considered extremely significant with mean ± SD (2.385 ± 1.075) for pre-test and (4.065 ± 0.8586) for post-test. Figure 17 shows pre- and post-test results for Group B mood component with two tailed ($P < 0.0001$) which is considered extremely significant with mean ± SD (3.88 ± 0.8569) for pre-test and (4.95 ± 0.2236) for post-test. Figure 18 shows pre- and post-test results for Group B personality component with two tailed (<0.0001) which is considered extremely significant with mean ± SD (3.675 ± 0.7239) for pre-test and (4.85 ± 0.3364) for post-test. Figure 19 shows pre- and post-test results for Group B self-care component with two tailed ($P < 0.0001$) which is considered extremely significant

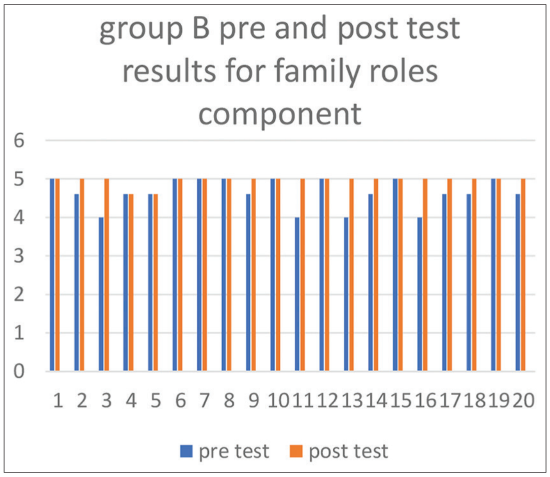

Figure 14: Stroke-Specific Quality of Life Scale results for Group B family roles component

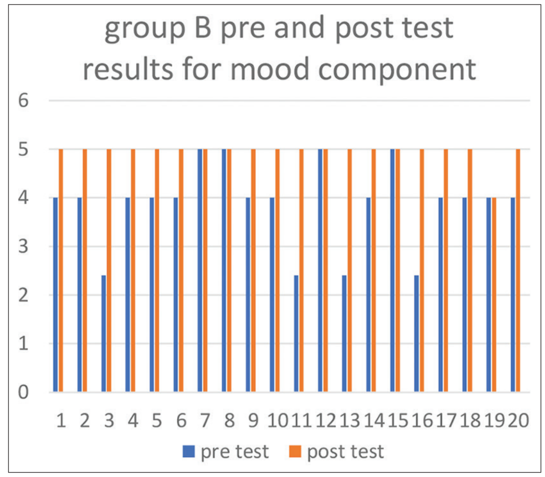

Figure 17: Stroke-Specific Quality of Life Scale results for Group B mood component

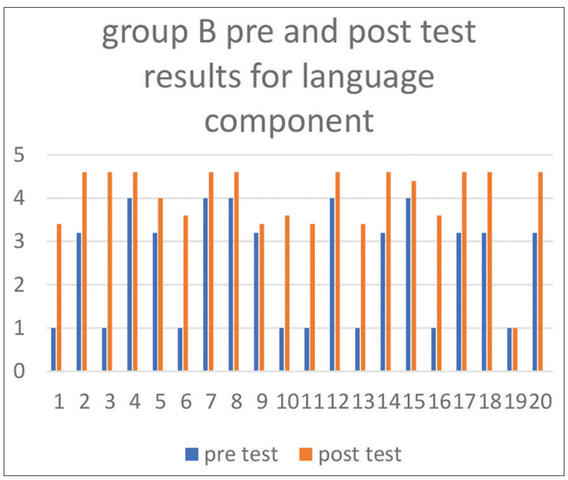

Figure 15: Stroke-Specific Quality of Life Scale results for Group B language component

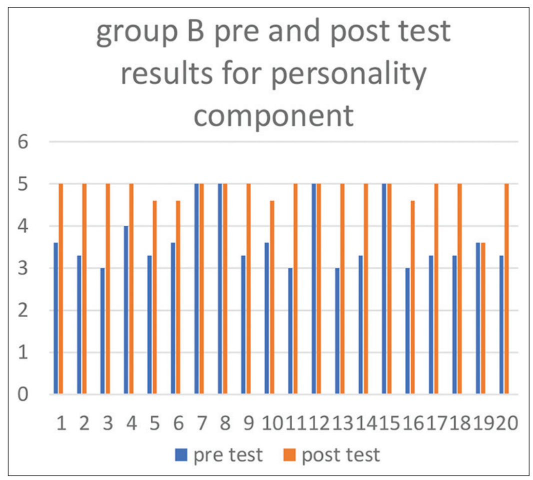

Figure 18: Stroke-Specific Quality of Life Scale results for Group B personality component

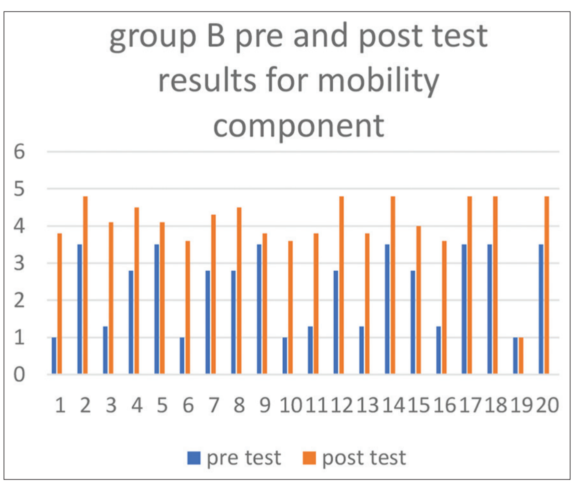

Figure 16: Stroke-Specific Quality of Life Scale results for Group B mobility component

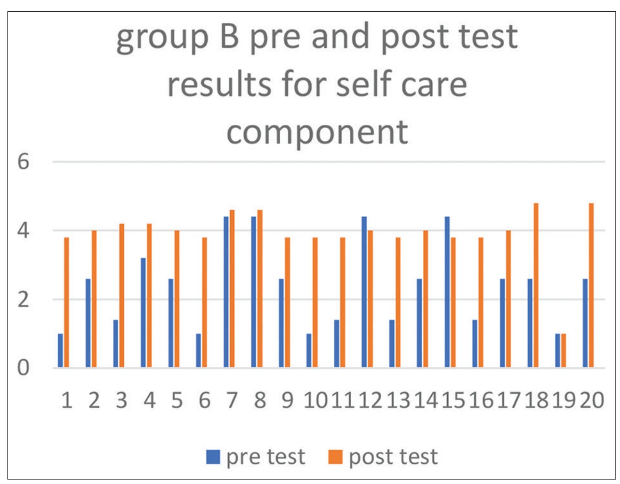

Figure 19: Stroke-Specific Quality of Life Scale results for Group B self-care component

with mean ± SD (2.43 ± 1.23) for pre-test and (3.93 ± 0.7713) for post-test. Figure 20 shows pre- and post-test results for Group B social roles component with two tailed (P = 0.0015) which is considered very significant with mean ± SD (2.58 ± 0.8408) for pre-test and (3.24 ± 0.5335) for post-test. Figure 21 shows pre- and post-test results for Group B thinking component with two tailed ($P < 0.0001$) which is considered extremely significant with mean ± SD (2.8 ± 0.7678) for pre-test and (3.93 ± 0.8291) for post-test. Figure 22 shows pre- and post-test results for Group B upper extremity function component with two tailed ($P < 0.0001$) which is extremely significant with mean ± SD (2 ± 1.124) for pre-test and (3.63 ± 0.7928) for post-test. Figure 23 shows pre- and post-test results for Group B vision component with two tailed ($P = 0.1250$) which is not significant with mean ± SD (4.8 ± 0.4104) for pre-test and (4.96 ± 0.1231) for post-test. Figure 24 shows pre- and post-test results for Group B work component with two tailed ($P < 0.0001$) which is extremely significant with mean ± SD (2 ± 1.124) for pre-test and (3.41 ± 0.8322) for post-test. Figure 25 shows post-test results for Groups A and B energy component with two tailed ($P = 0.0010$) which is very significant with mean ± SD (3.05 ± 1.077) for Group A and (4.34 ± 0.8003) for Group B. Figure 26 shows post-test results for family roles component with two tailed ($P < 0.0001$) which is extremely significant with mean ± SD (3.935 ± 0.4614) for Group A and (4.96 ± 0.1231) for Group B. Figure 27 shows post-test results for language component with two tailed ($P = 0.0001$) which is extremely significant with mean ± SD (2.21 ± 1.061) for Group A and (3.99 ± 0.8789) for Group B. Figure 28 shows post-test

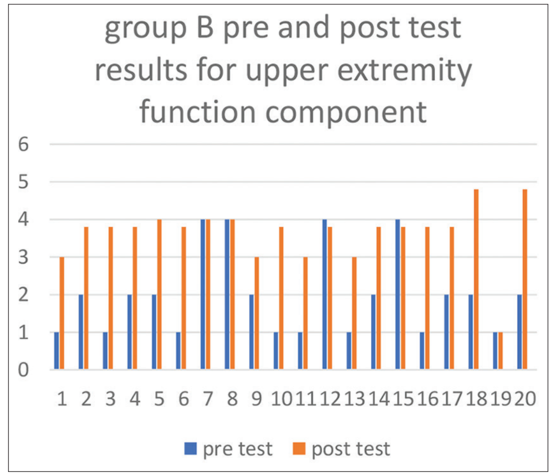

Figure 22: Stroke-Specific Quality of Life Scale results for thinking component

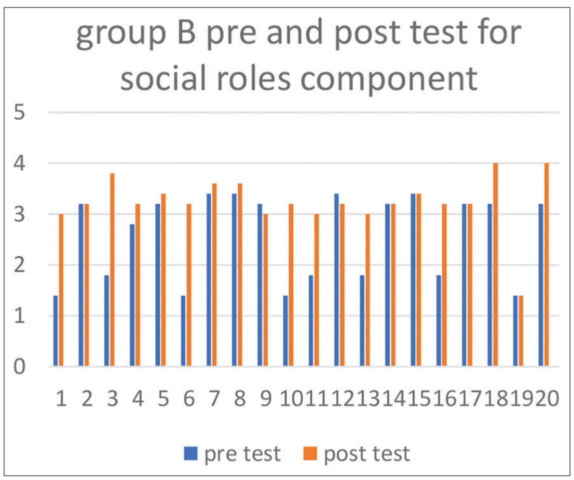

Figure 20: Stroke-Specific Quality of Life Scale results for Group B social roles component

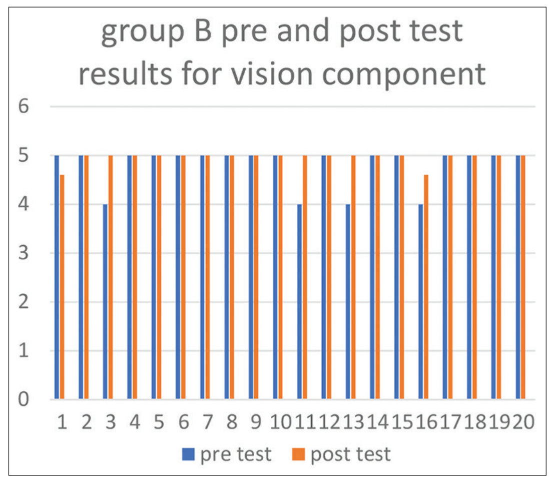

Figure 23: Stroke-Specific Quality of Life Scale results for vision component

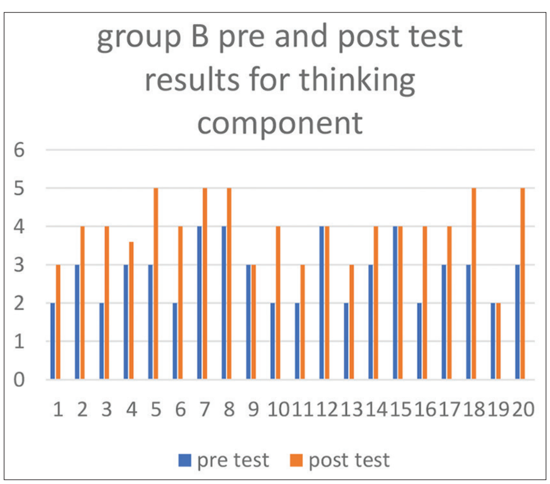

Figure 21: Stroke-Specific Quality of Life Scale results for upper extremity component

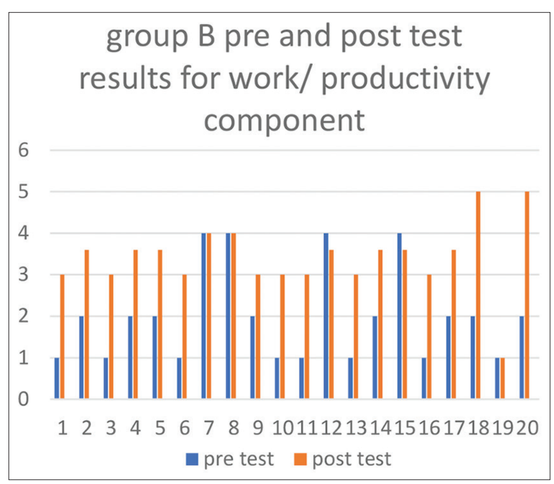

Figure 24: Stroke-Specific Quality of Life Scale results for work component

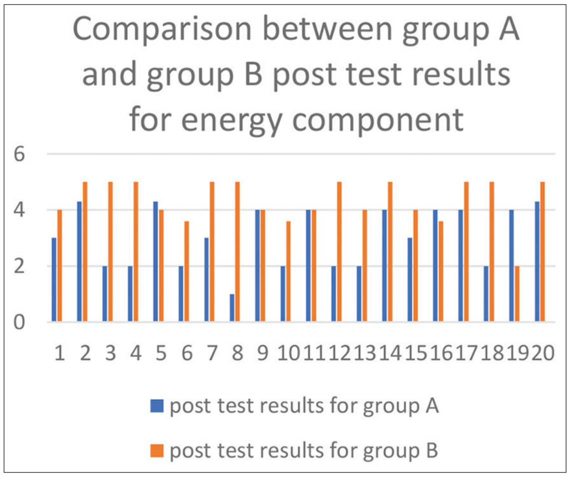

Figure 25: Stroke-Specific Quality of Life Scale results for energy component

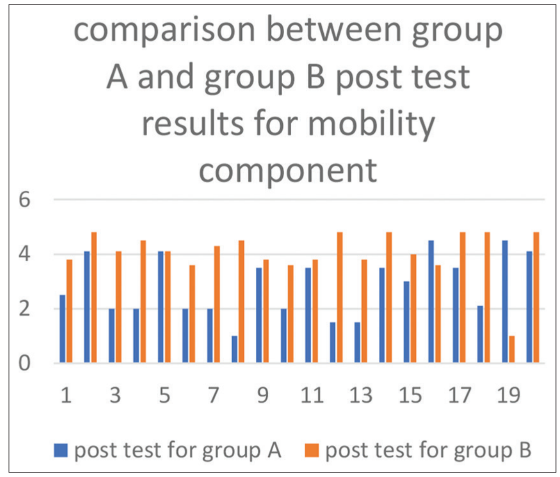

Figure 28: Stroke-Specific Quality of Life Scale results for mobility component

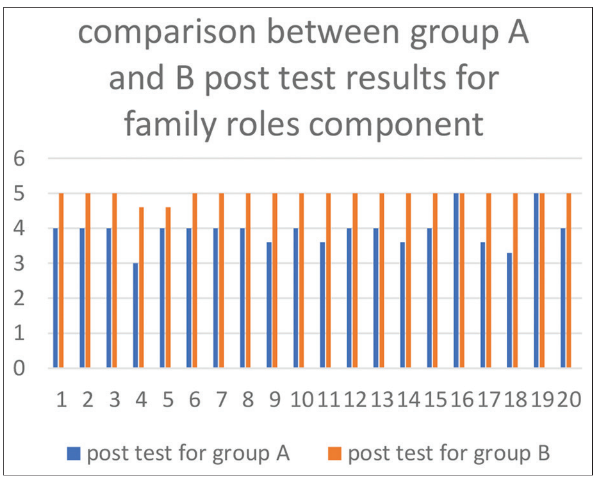

Figure 26: Stroke-Specific Quality of Life Scale results for family roles component

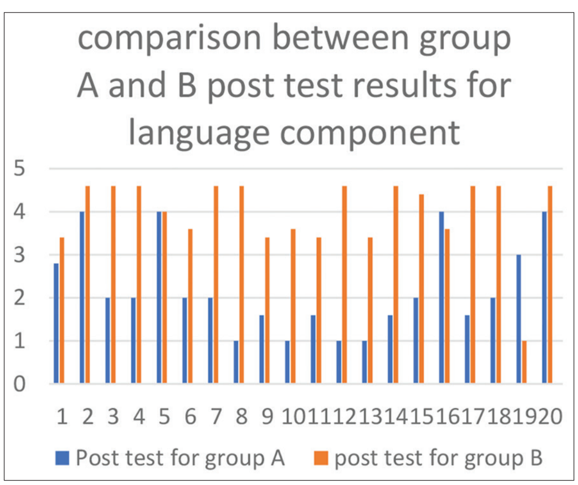

Figure 27: Stroke-Specific Quality of Life Scale results for language component

results for mobility component with two tailed ($P = 0.0024$) which is very significant with mean ± SD (2.845 ± 1.105) for Group A and (4.065 ± 0.8586) for Group B. Figure 29 shows post-test results for mood component with two tailed ($P = 0.0003$) which is extremely significant with mean ± SD (3.77 ± 1.033) for Group A and (4.95 ± 0.2236) for Group B. Figure 30 shows post-test results for personality component with two tailed ($P = 0.0008$) which is extremely significant with mean ± SD (3.49 ± 1.349) for Group A and (4.85 ± 0.3364) for Group B. Figure 31 shows post-test results for self-care component with two tailed ($P = 0.0010$) which is extremely significant with mean ± SD (2.62 ± 0.7811) for Group A and (3.93 ± 0.7713) for Group B. Figure 32 shows post-test results for social roles component with two tailed ($P = 0.0012$) which is very significant with mean ± SD (2.39 ± 0.6569) for Group A and (3.24 ± 0.5335) for Group B. Figure 33 shows post-test results for thinking component with two tailed ($P = 0.0052$) which is very significant with mean ± SD (2.85 ± 0.8751) for Group A and (3.93 ± 0.8291) for Group B. Figure 34 shows post-test results for upper extremity function component with two tailed ($P = 0.0006$) which is extremely significant with mean ± SD (2.03 ± 0.5992) for Group A and (3.63 ± 0.7928) for Group B. Figure 35 shows post-test results for vision component with two tailed ($P < 0.0001$) which is extremely significant with mean ± SD (3.23±0.8560) for Group A and (4.96±0.1231) for Group B. Figure 36 shows post-test results for work component with two tailed (p=0.0005) which is extremely significant with mean ± SD (1.98 ± 0.7016) for Group A and (3.41 ± 0.8322) for Group B.

Considering Modified Barthel's Index as outcome measure, there were *not significant* results for Group A ambulation component [Figure 37] with $P = 0.1094$ and 8.85 ± 5.824 for pre-test and 9.9 ± 4.909 for post-test, for Group A wheelchair component [Figure 38] with $P = 0.5000$ and 4.2 ± 1.735 for pre-test and 4.45 ± 1.276 for post-test, for Group A stair climbing component [Figure 39] with $P = 0.6875$ and 5.8 ± 2.587 for pre-test and 6.05 ± 2.564 for post-test, for Group A toilet component [Figure 40] with $P = 1094$ and 7.4 ± 2.845 for pre-test and 8.05 ± 2.235 for post-test, for Group A bowel component [Figure 41] with $P > 0.9999$ and 9.5 ± 0.8885 for pre-test and 9.4 ± 0.9403 for post-test, for Group A bladder component [Figure 42] with $P > 0.9999$ and 9.25 ± 1.832 for pre-test and 9.4 ± 1.569 for post-test, for Group A bathing component [Figure 43] with $P = 0.5000$ and 3.9 ± 0.5525 for pre-test and 3.8 ± 0.4104 for post-test, for Group A dressing component [Figure 44] with $P = 0.3750$ and 5.45 ± 1.468 for pre-test and 5.9 ± 1.41 for post-test, for

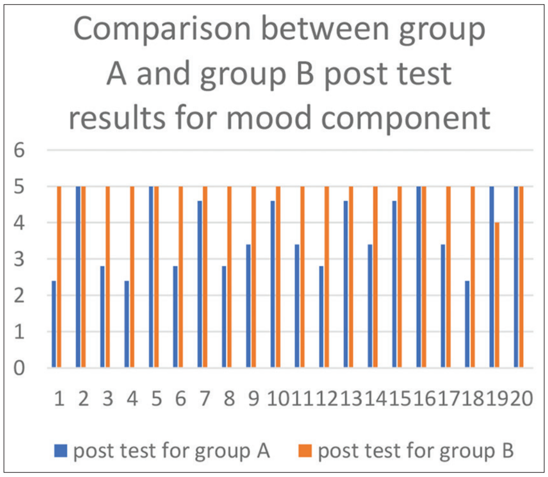

Figure 29: Stroke-Specific Quality of Life Scale results for mood component

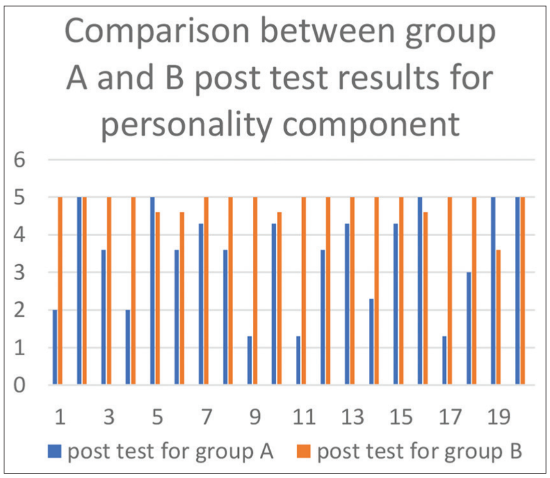

Figure 30: Stroke-Specific Quality of Life Scale results for personality component

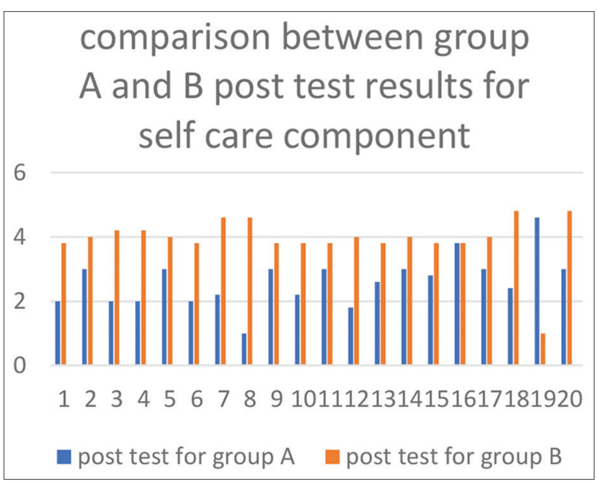

Figure 31: Stroke-Specific Quality of Life Scale results for self-care component

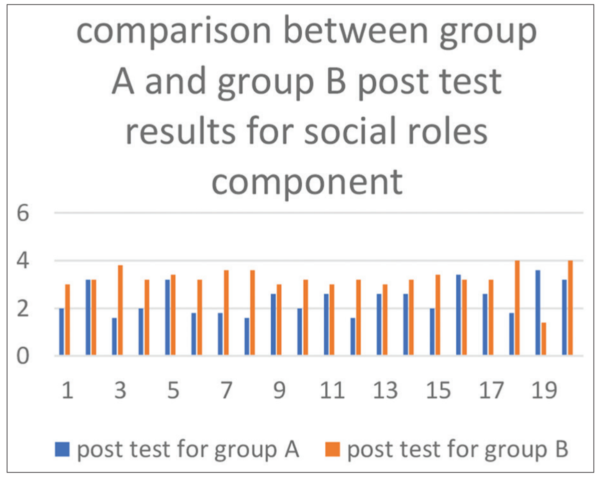

Figure 32: Stroke-Specific Quality of Life Scale results for social roles component

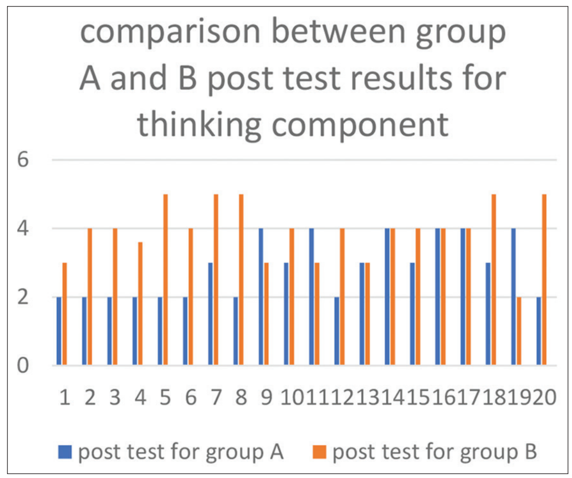

Figure 33: Stroke-Specific Quality of Life Scale results for thinking component

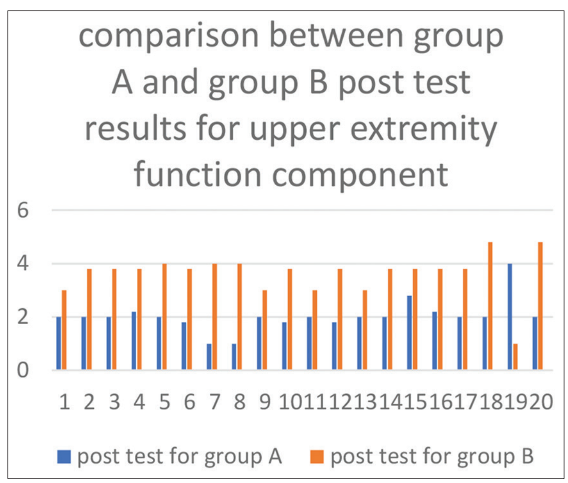

Figure 34: Stroke-Specific Quality of Life Scale results for upper extremity function component

Group A personal hygiene component [Figure 45] with $P = 0.8438$ and 3.65 ± 0.6708 for pre-test and 3.6 ± 0.5026 for post-test, for Group A feeding component [Figure 46] with $P = 0.2969$ and 5.9 ± 2.532 for pre-test and (6.45 ± 2.114) for post-test, for Group B

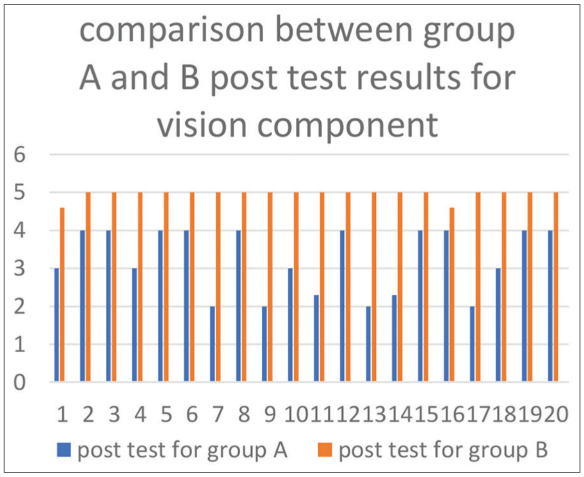

Figure 35: Stroke-Specific Quality of Life Scale results for vision component

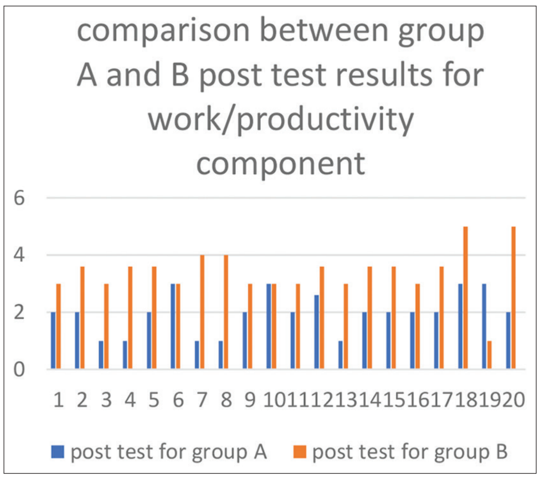

Figure 36: Stroke-Specific Quality of Life Scale results for work component

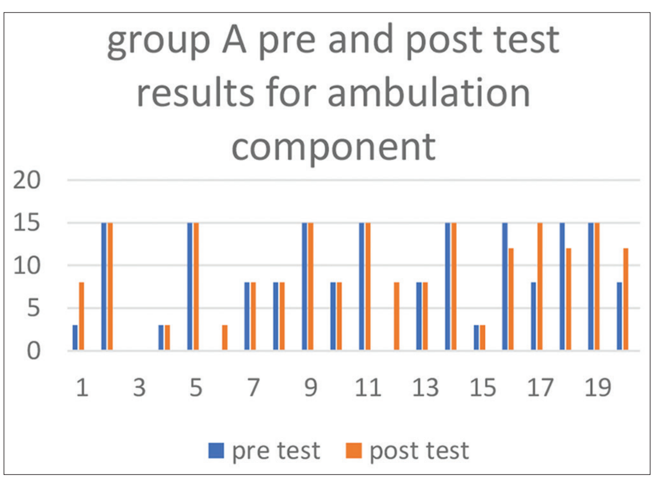

Figure 37: Modified Barthel Index results for ambulation

wheelchair component [Figure 47] with P = 0.0625 and 4.2 ± 1.508 for pre-test and 4.9 ± 0.3078 for post-test, for Group B bowel

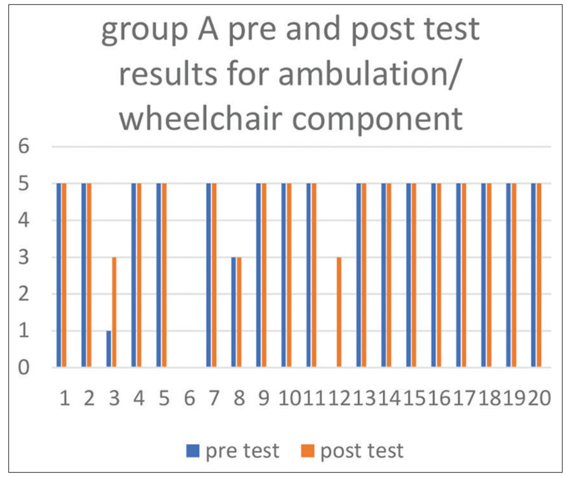

Figure 38: Modified Barthel Index results for wheelchair

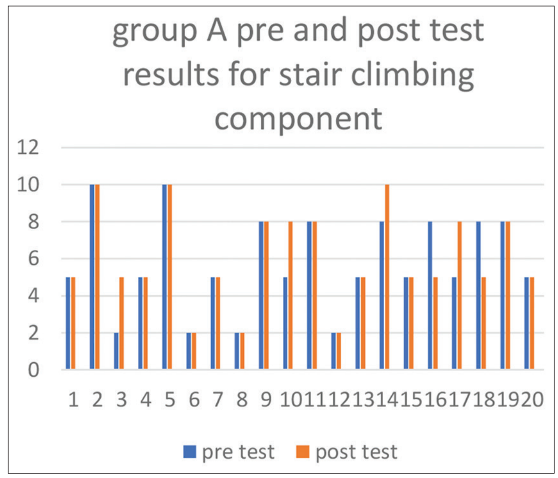

Figure 39: Modified Barthel Index results for stair climbing

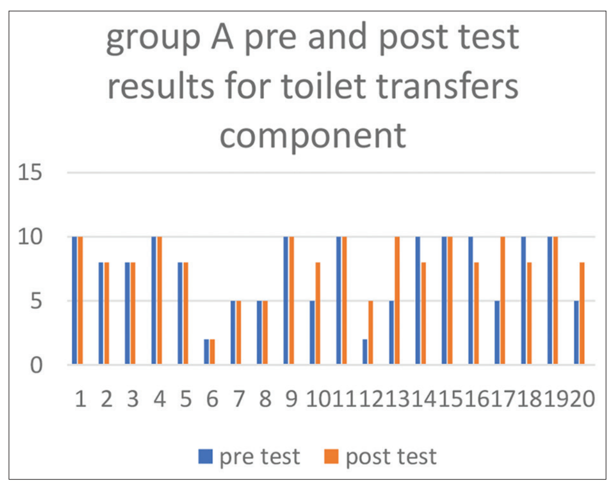

Figure 40: Modified Barthel Index results for toilet transfer

control component [Figure 48] with P = 0.0625 and 9.4 ± 0.9403 for pre-test and 9.9 ± 0.4472 for post-test, for Group B bladder control component [Figure 49] with P = 0.1250 and 9.5 ± 0.8885 for pre-test and 9.9 ± 0.4472 for post-test, for Groups A and B ambulation

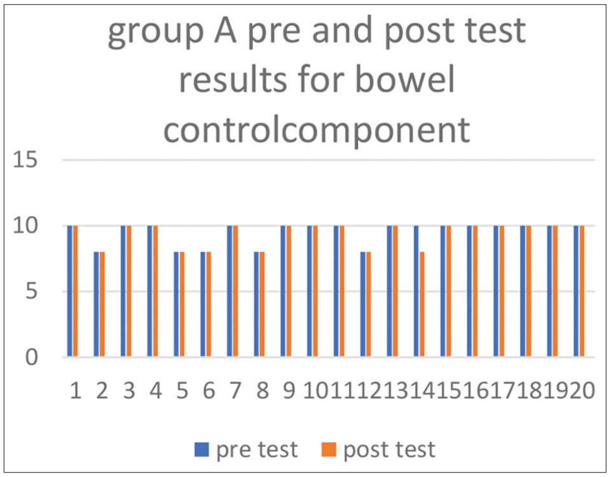

Figure 41: Modified Barthel Index results for bowel control

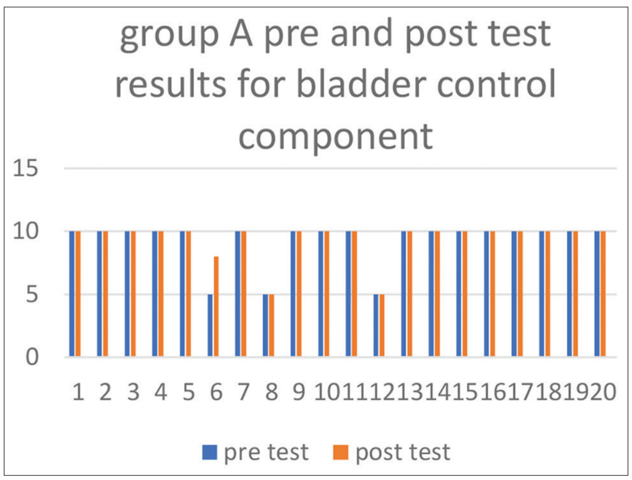

Figure 42: Modified Barthel Index results for bladder control

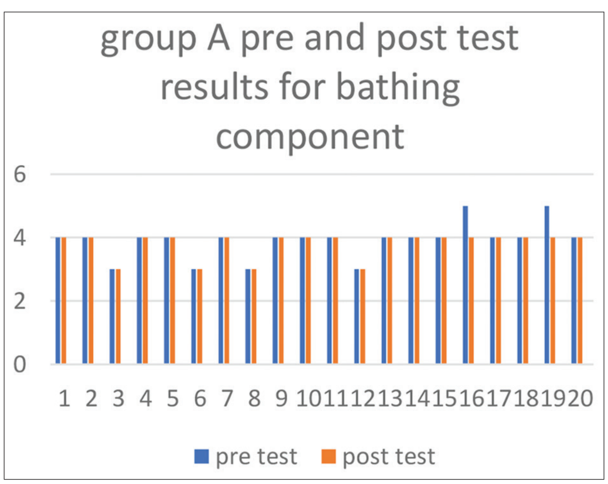

Figure 43: Modified Barthel Index results for bathing

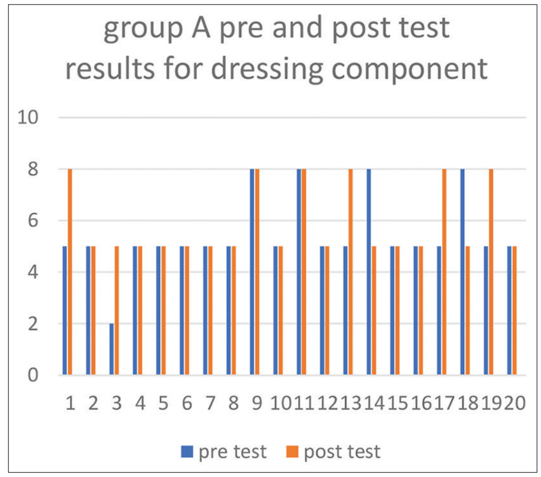

Figure 44: Modified Barthel Index for dressing

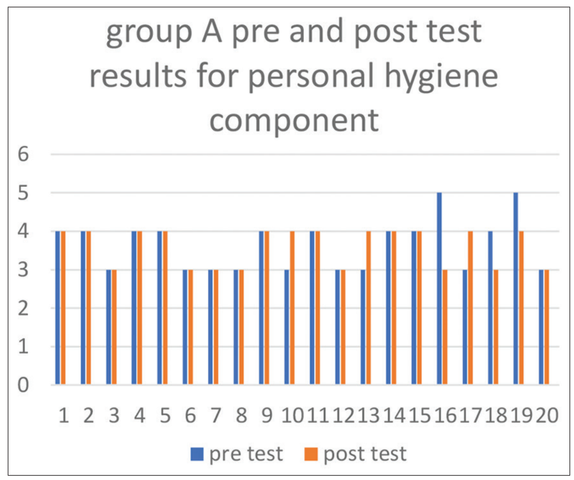

Figure 45: Modified Barthel Index for personal hygiene

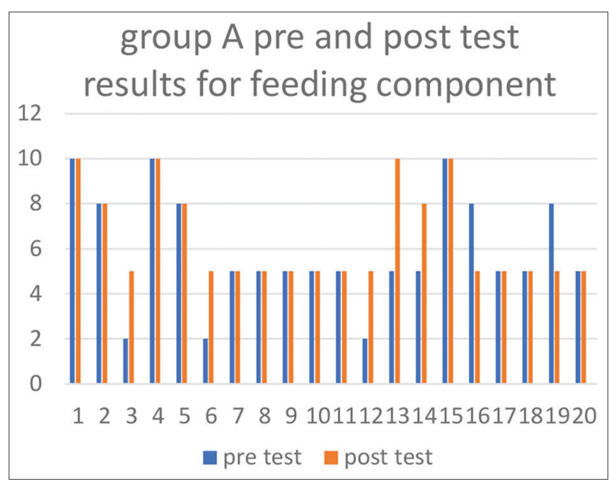

Figure 46: Modified Barthel Index for feeding

component [Figure 50] with $P = 0.0605$ and 9.9 ± 4.909 for post-test Group A and 12.4 ± 2.644 for post-test Group B, for Groups A and B wheelchair component [Figure 51] with $P = 0.1563$ and 4.45 ± 1.276 for post-test Group A and 4.9 ± 0.3078 for post-test Group B, for post-test Groups A and B toilet transfer component [Figure 52] with $P = 0.0742$ and 8.05 ± 2.235 for post-test Group A and 9.15 ± 1.348 for post-test Group B, for post-test Groups A and B bowel control component [Figure 53] with $P = 0.1094$ and 9.4 ± 0.9403

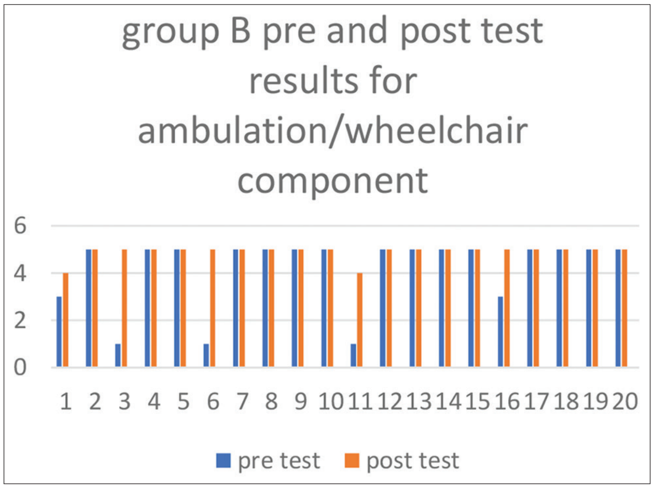

Figure 47: Modified Barthel Index for wheelchair

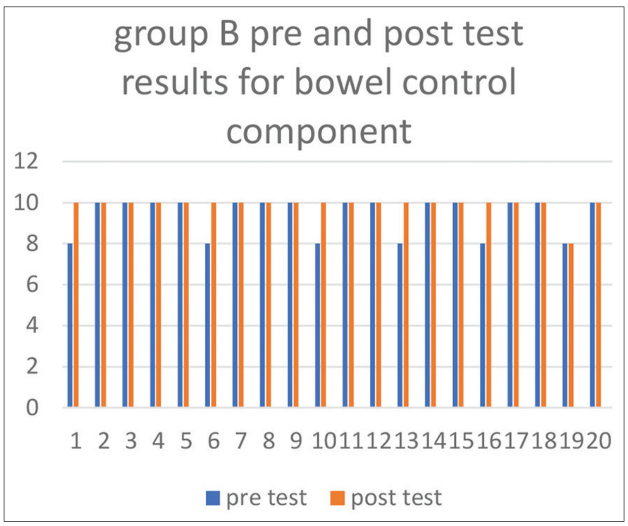

Figure 48: Modified Barthel Index for bowel control

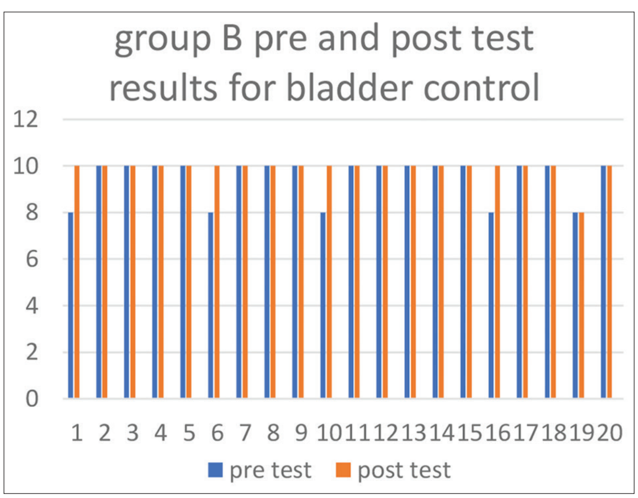

Figure 49: Modified Barthel Index for bladder control

for post-test Group A and 9.9 ± 0.4472 for post-test Group B, for post-test Groups A and B bladder control component [Figure 54]

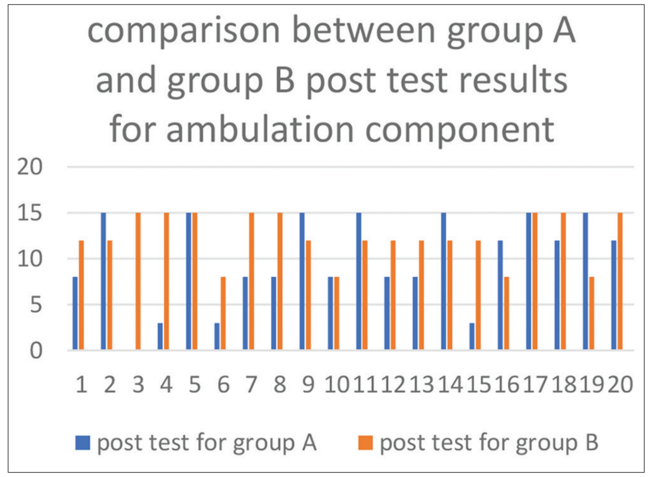

Figure 50: Modified Barthel Index for ambulation

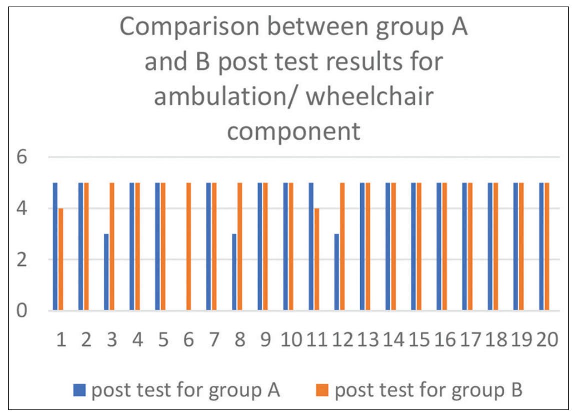

Figure 51: Modified Barthel Index for wheelchair

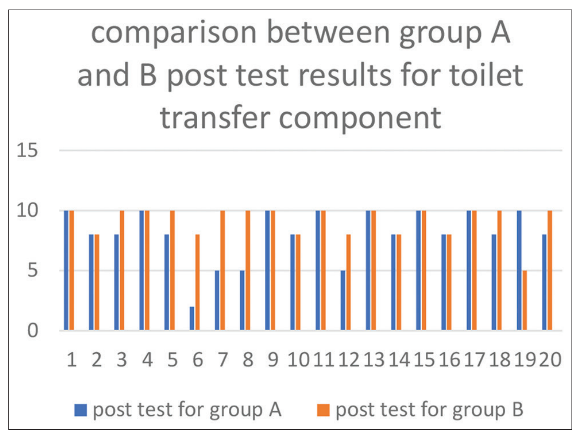

Figure 52: Modified Barthel Index for toilet transfer

with $P = 0.2500$ and 9.4 ± 1.569 for post-test Group A and 9.9 ± 0.4472 for post-test Group B, there were *significant* results for post-test Groups A and B chair transfer component [Figure 55] with $P = 0.0110$ and 10 ± 4.877 for Group A and 13.2 ± 1.508 for Group B, for post-test Groups A and B feeding component [Figure 56] with $P = 0.0139$ and 6.45 ± 2.114 for Group A and 8.1 ± 1.832 for Group B, there were *very significant* results for post-test Groups A and B stair climb component [Figure 57] with $P = 0.0017$ and 4.45 ± 1.276 for

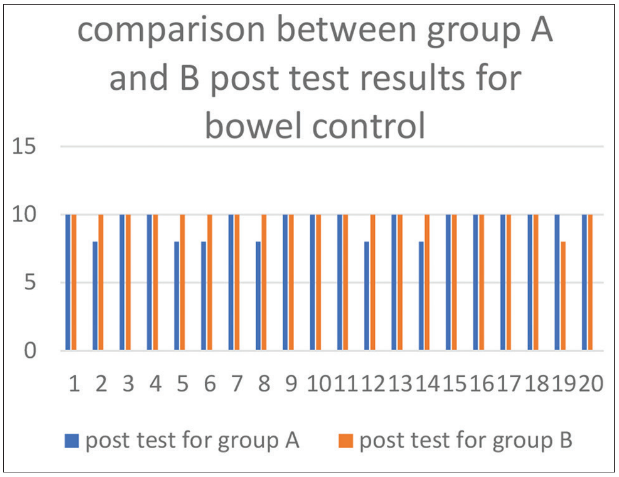

Figure 53: Modified Barthel Index for bowel control

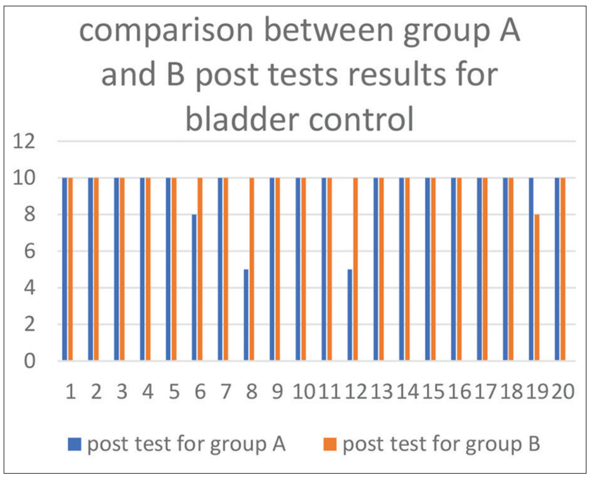

Figure 54: Modified Barthel Index for bladder control

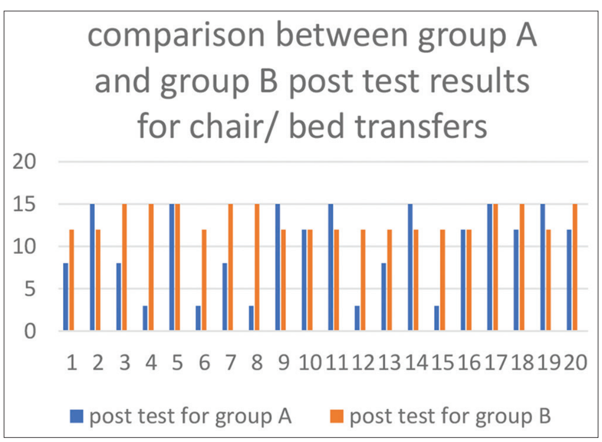

Figure 55: Modified Barthel Index for chair transfers

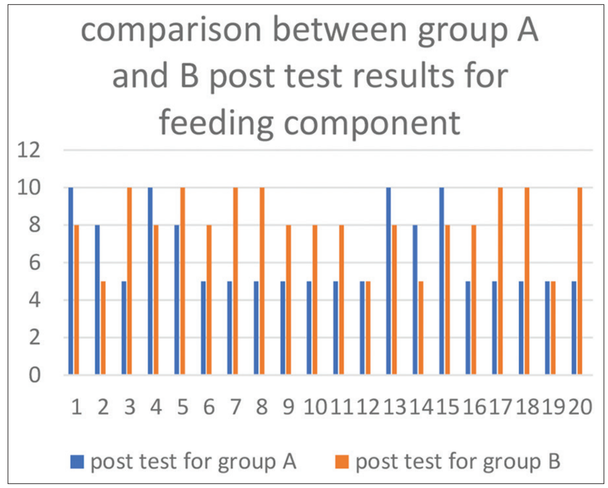

Figure 56: Modified Barthel Index for feeding

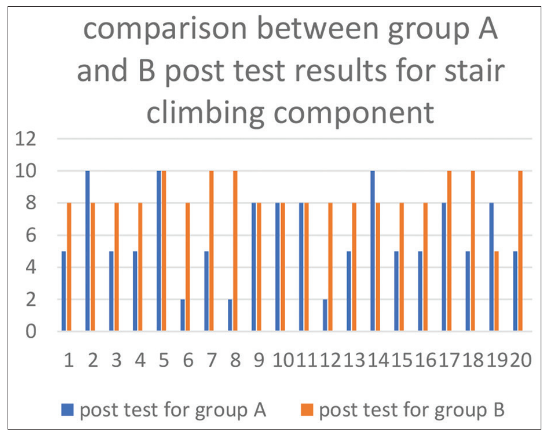

Figure 57: Modified Barthel Index for stair climbing

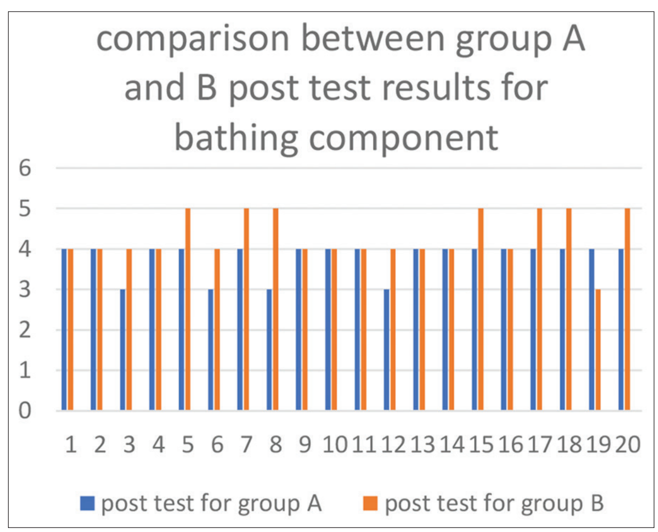

Figure 58: Modified Barthel Index for bathing

Group A and 4.9 ± 0.3078 for Group B, for post-test Groups A and B bathing component [Figure 58] with $P = 0.0098$ and 3.8 ± 0.4104 for Group A and 4.3 ± 0.5712 for Group B, for post-test Groups A and B dressing component [Figure 59] with $P = 0.0084$ and 5.9 ± 1.41 for Group A and 8.25 ± 1.943 for post-test, for post-test Groups A and B personal hygiene component [Figure 60] with $P = 0.0024$ and 3.6 ± 0.5026 for Group A and 4.45 ± 0.6048 for Group B, there were *extremely significant* results for Group A chair transfer component [Figure 61] with $P = 0.0002$ and 8.75 ± 5.775 for pre-test and 10 ± 4.877 for post-test, for Group B chair transfer component

[Figure 62] with $P = 0.0010$ and 10.45 ± 3.332 for pre-test and 13.2 ± 1.508 for post-test, for Group B ambulation component [Figure 63] with $P = 0.0002$ and 8.15 ± 5.314 for pre-test and 12.4 ± 2.644 for post-test, for Group B stair climbing component [Figure 64] with $P = 0.0002$ and 6.35 ± 2.277 for pre-test and 8.45 ± 1.234 for post-test, for Group B toilet transfer component [Figure 65] with $P = 0.0002$ and 7.25 ± 2.074 for pre-test and 9.15 ± 1.348 for

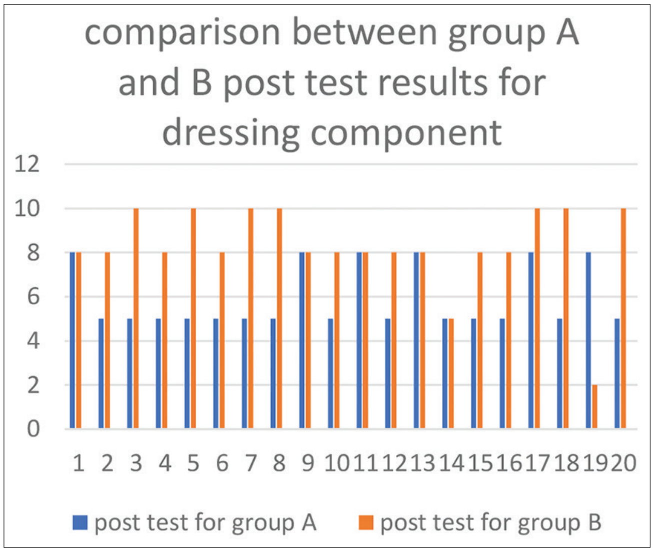

Figure 59: Modified Barthel Index for dressing

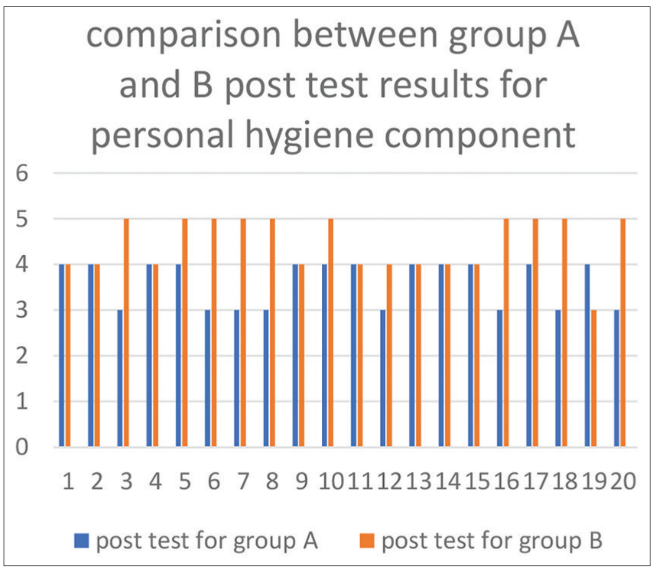

Figure 60: Modified Barthel Index for personal hygiene

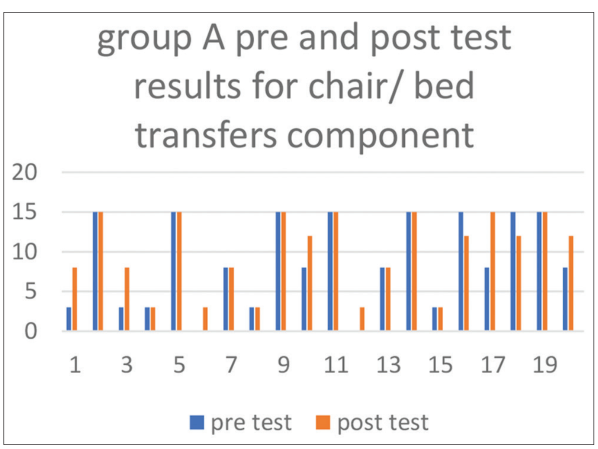

Figure 61: Modified Barthel Index results for chair transfer

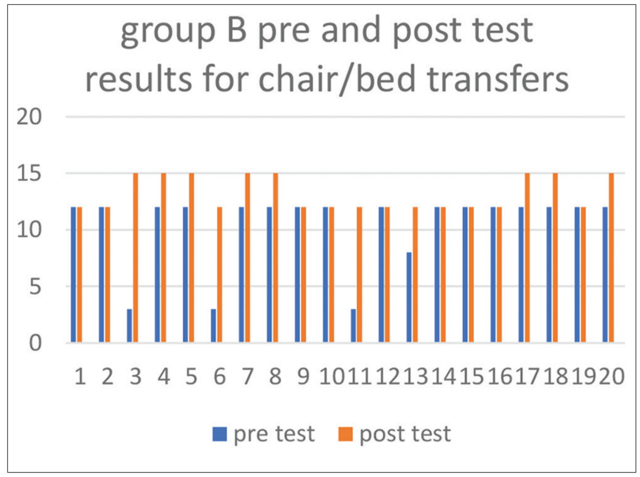

Figure 62: Modified Barthel Index for chair transfer

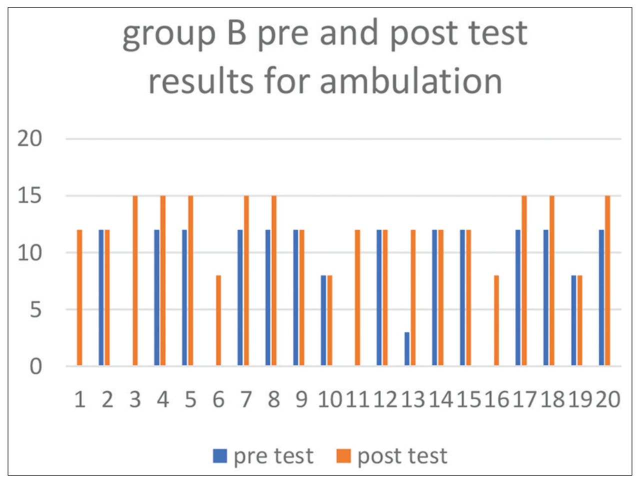

Figure 63: Modified Barthel Index for ambulation

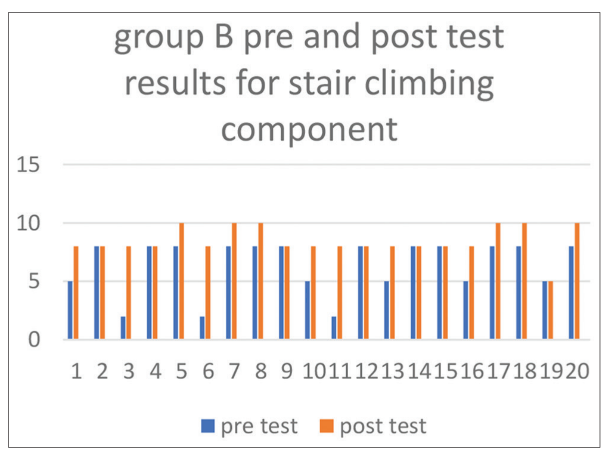

Figure 64: Modified Barthel Index for stair climbing

post-test, for Group B bathing component [Figure 66] with P = 0.0001 and 3.6 ± 0.5026 for pre-test and 4.3 ± 0.5712 for post-test, for Group B dressing component [Figure 67] with P = 0.0001 and 4.3 ± 2.105 for pre-test and 8.25 ± 1.943 for post-test, for Group B personal hygiene component [Figure 68] with P = 0.0002 and 3.6 ± 0.5026 for pre-test and 4.45 ± 0.6048 for post-test, and for Group B feeding component [Figure 69] with P = 0.0001 and 5 ± 1.686 for pre-test and 8.1 ± 1.832 for post-test.

Discussion

The study was undertaken using power training as a concept for chronic stroke survivors, that is, more than 6 months. The two concepts resistance training and power training are usually thought to be the same, however, there is a clear difference between those two training methodologies.[9] The definition for resistance training is "as an activity that is designed to improve muscular fitness by exercising a muscle or muscle group against external resistance."[9] Power training usually falls under the roof of strength training but has a precise definition of "an activity that is designed to improve muscular fitness by developing a muscle or muscle groups ability to contract a maximum force in minimal time."[27] Ouellette *et al*.[21] done a research on resistance training and trained individuals at 70% of 1RM, which is considered as a high-intensity intervention and assessed locomotor performance in chronic stroke individuals which has shown limited effects. Individuals performed three sets of 8–10

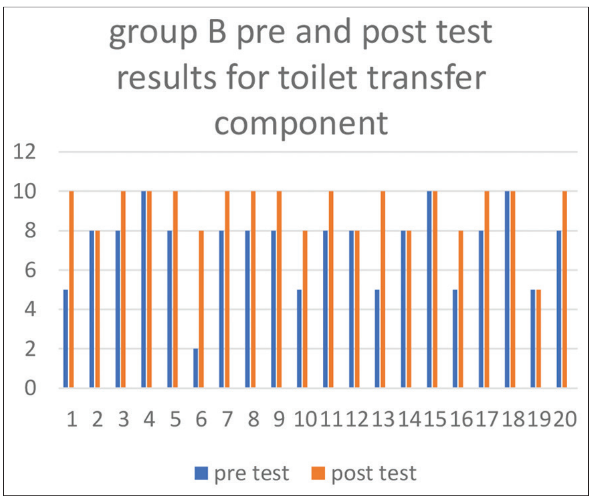

Figure 65: Modified Barthel Index for toilet transfer

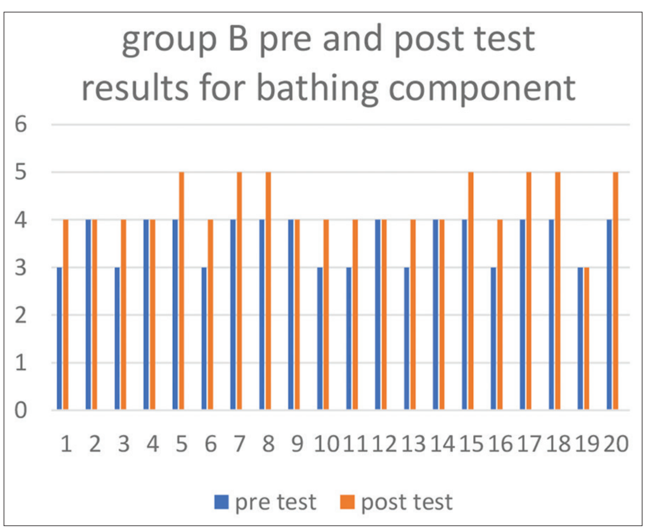

Figure 66: Modified Barthel Index for bathing control

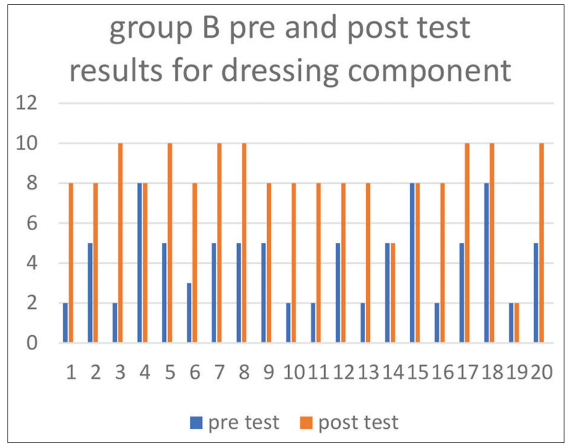

Figure 67: Modified Barthel Index for dressing

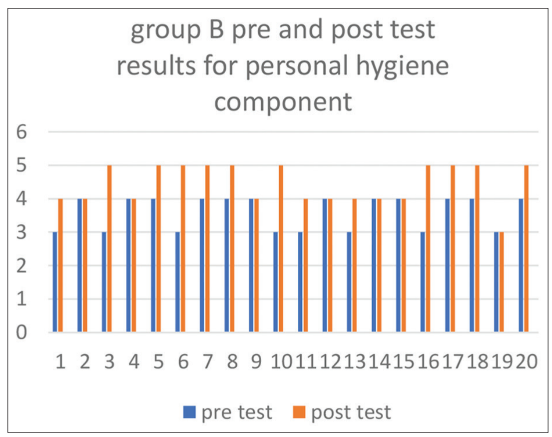

Figure 68: Modified Barthel Index for personal hygiene

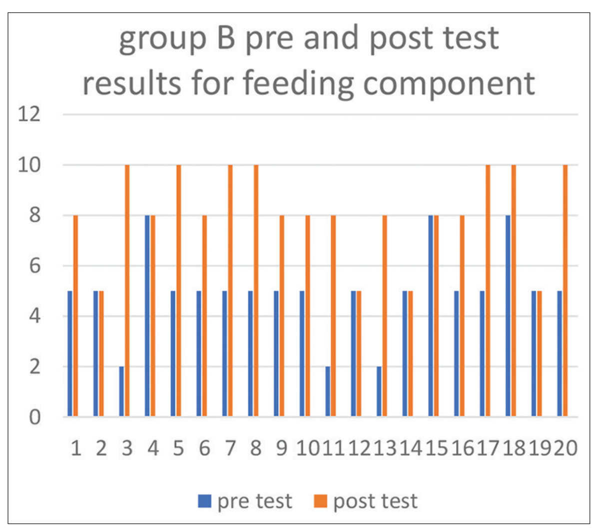

Figure 69: Modified Barthel Index for feeding

repetitions of leg press, unilateral knee extension, unilateral ankle dorsiflexion, and plantar flexion with training intensity adjusted twice a week by reconsidering 1RM. All muscle groups tested had suggestively seen improvement in strength with the exception of the non-paretic ankle dorsiflexors under progressive training group. There was improvement in knee extensors by 31.4% for paretic limb and 38.2% for non-paretic limb. In addition, there was 33% increment for paretic limb and 28.5% for non-paretic knee extensors. However, there was no significant improvement in SSWS, FCWS, and 6 MWT after a 12 weeks intervention. Few studies have shown results favoring functional task practice when compared to strengthening and task practice for post-stroke individuals in subacute[28] and chronic periods of recovery.[29] Two studies[30,31] have shown good results for upper extremity function resistance training. But still, combination of functional task practice and power training, that is, hybrid intervention shows better benefits on all compared to functional task practice alone.[32] There is a definitive characteristic weakness post-stoke which is known as hemiparesis, yet the correlation between increased strength and improved function has been difficult to understand.[32] The study analyzed the safety and efficacy of power training for chronic stroke survivors. Their motive is inclusion of power training (i.e., dynamic and high-intensity resistance training) which is feasible without negative repercussions including either impairments of musculoskeletal system or increment of spasticity. Thus, it is justified that post-stroke hemiparesis can be improved by focusing on the weakened component.

In case of chronic stroke, there is mostly reciprocal inhibition, for example, weakness of biceps and spasticity of triceps, so there is a need to work more on weakness of biceps for improving the QOL in case of chronic stroke survivors. Usually, power training is applied for lower motor neuron lesions,[25] but for improving QOL, we are applying this concept for upper motor neuron lesions, that is, stroke to overcome weakness by reciprocal inhibition. Researchers have proven that power training would not increase spasticity.[32] Taking all the precautions, the present study was conducted on 40 chronic stroke patients of which 20 were given conventional treatment program and rest 20 were treated with power training along with conventional treatment protocol. In the present study, QOL of patients was analyzed using SSQOL scale and the functional independence measure was assessed using Modified Barthel's Index. The treatment protocol lasted for 6 weeks with alternate days of treatment; with progression of weight and reduced repetitions which are asked to be done in minimal time. Maximum amount of weight lifted as fast as possible helps to improve power of weakened muscles. To objectify, the muscle power during movement helps to bridge the link between strength and functional performance in post-stroke hemiparesis individuals with compromised motor functions. There is more increment in neuromuscular and mechanical power by applying high-velocity training if compared to strength training and is also helpful in improving performance on functional tasks.[33,34] Certain publishers have shown rise in corticospinal excitability and particularly fall of GABA-mediated short intracortical inhibition (SICI) following 6 weeks of power training.[35] This clearly proves functional changes in strength of corticospinal projections following resistance training, reducing levels of SICI are more beneficial for chronic stroke individuals in gaining strength and improving power thus improving QOL.[32]

For Group A (conventional treatment protocol), stretching and passive range of motion exercises were given to stretch and relax the muscles.[36] Few activities such as catch/release the ball, water task, feeding, dressing/laundry,[32] and peck board were given for 10 min each exercise. For progression, higher levels of activities were given.[32] For Group B, power training was combined with conventional treatment protocol as hybrid intervention shows good results compared to conventional treatment alone.[32] For power training, mainly therapeutic gymnasium was used which includes bicycle, leg press, springs, and exercises such as double limb jump, calf raises, and sit to stand[9] were given. For progression, for every 10% increase weight, reduce the number of repetitions every 2 weeks for gaining the power.[9] For both the groups, progression was done after every 2 weeks. Later after 6 weeks, post-treatment assessment was done using SSQOL scale, Modified Barthel's Index as outcome measures. Considering *SSQOL* scale, there was *significant* correlation for Group A pre- and post-test results for social roles [Figure 9] and work/productivity [Figure 12] components. A *very significant* correlation is seen for Group A pre- and post-test results for energy [Figure 1], self-care [Figure 8], and upper extremity function component [Figure 10]. Similarly very significant correlation is seen for group B pre and post test results for family roles [Figure 14], social roles [Figure 20] and the post test comparative study results among group A and B for energy [Figure 25], mobility [Figure 28], social roles [Figure 32], thinking [Figure 33] components. Extremely significant correlation was seen for Group B pre- and post-test results for energy [Figure 13], language [Figure 15], mobility [Figure 16], mood [Figure 17], personality [Figure 18], self-care [Figure 19], thinking [Figure 21], upper extremity function [Figure 22], and work/productivity component [Figure 24] and also for post-test comparative study results among Groups A and B for family roles [Figure 26], language [Figure 27], mood [Figure 29], personality [Figure 30], self-care [Figure 31], upper extremity function [Figure 34], vision [Figure 35], and work/productivity [Figure 36] components. Now considering Modified Barthel's Index scale, there was *significant* correlation for post-test comparative study results among Groups A and B for chair [Figure 55] and feeding [Figure 56] components. A *very significant* correlation is seen for post-test comparative study results among Groups A and B for stair climbing [Figure 57], bathing [Figure 58], dressing [Figure 59], and personal hygiene [Figure 60] components. Moreover, extremely significant correlation is observed for Group A chair/bed transfers [Figure 61], for Group B chair/bed transfers [Figure 62], ambulation [Figure 63], stair climbing [Figure 64], toilet [Figure 65], bathing [Figure 66], dressing [Figure 67], personal hygiene [Figure 68], and feeding [Figure 69] components. The activities used in group B have maximum kinetic energy, which have uplifted positive energy in following push off phase leading to improved performance in later stages. As reciprocal inhibition is seen in chronic stages of stroke, power training helps to enhance agonist and antagonist muscle action, leading to increase joint and muscle power production.[37]

Conclusion

This study concluded that combination of conventional treatment protocol and power training for chronic stroke survivors improved their QOL with significant, very significant, and extremely significant correlation compared to conventional treatment protocol alone.

Acknowledgments

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References

1. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, *et al*. Heart disease and stroke statistics-2013 update: A report from the American Heart Association. Circulation 2013;127:e6-245.
2. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, *et al*. Heart disease and stroke statistics-2007 update: A report from the American heart association statistics committee and stroke statistics subcommittee. Circulation 2007;115:e69-171.
3. Teixeira-Salmela LF, Olney SJ, Nadeau S, Brouwer B. Muscle strengthening and physical conditioning to reduce impairment and disability in chronic stroke survivors. Arch Phys Med Rehabil 1999;80:1211-8.
4. Harris ML, Polkey MI, Bath PM, Moxham J. Quadriceps muscle weakness following acute hemiplegic stroke. Clin Rehabil 2001;15:274-81.
5. Hsiao DN. Knee muscle isometric strength, voluntary activation and antagonist co-contraction in the first six months after stroke. Disabil Rehabil 2001;23:379-86.
6. Perry J, Garrett M, Gronley JK, Mulroy SJ. Classification of walking handicap in the stroke population. Stroke 1995;26:982-9.
7. Beyaert C, Vasa R, Frykberg GE. Gait post-stroke: Pathophysiology and rehabilitation strategies. Neurophysiol Cliniq Clin Neurophysiol 2015;45:335-55.
8. Algurén B, Lundgren-Nilsson Å, Sunnerhagen KS. Functioning of stroke survivors-a validation of the ICF core set for stroke in Sweden. Disabil Rehabil 2010;32:551-9.
9. Aaron SE, Hunnicutt JL, Embry AE, Bowden MG, Gregory CM. POWER training in chronic stroke individuals: differences between responders and nonresponders. Top Stroke Rehabil 2017;24:496-502.
10. Harris JE, Eng JJ. Goal priorities identified through client-centred measurement in individuals with chronic stroke. Physiother Can 2004;56:171.
11. Ambulation and self-care are goals of rehabilitation after stroke. Geriatrics 1976;31:61-5.
12. Bohannon RW, Andrews AW, Smith MB. Rehabilitation goals of patients with hemiplegia. Int J Rehabil Res 1988;11:181-4.
13. Lee MJ, Kilbreath SL, Singh MF, Zeman B, Lord SR, Raymond J, *et al*. Comparison of effect of aerobic cycle training and progressive resistance training on walking ability after stroke: A randomized sham exercise-controlled study. J Am Geriatr Soc 2008;56:976-85.
14. Macko RF, DeSouza CA, Tretter LD, Silver KH, Smith GV, Anderson PA, *et al*. Treadmill aerobic exercise training reduces the energy expenditure and cardiovascular demands of hemiparetic gait in chronic stroke patients: A preliminary report. Stroke 1997;28:326-30.
15. McCrimmon CM, King CE, Wang PT, Cramer SC, Nenadic Z, Do AH. Brain-controlled functional electrical stimulation therapy for gait rehabilitation after stroke: A safety study. J Neuroeng Rehabil 2015;12:1-2.
16. Kim YW, Moon SJ. Effects of treadmill training with the eyes closed on gait and balance ability of chronic stroke patients. J Phys Ther Sci 2015;27:2935-8.
17. Laufer Y, Dickstein R, Chefez Y, Marcovitz E. The effect of treadmill training on the ambulation of stroke survivors in the early stages of rehabilitation: A randomized study. J Rehabil Res Dev 2001;38:69-78.
18. Hesse S, Werner C, Bardeleben A, Barbeau H. Body weight-supported treadmill training after stroke. Curr Atherosc Rep 2001;3:287-94.
19. Del Din S, Bertoldo A, Sawacha Z, Jonsdottir J, Rabuffetti M, Cobelli C, *et al*. Assessment of biofeedback rehabilitation in post-stroke patients combining fMRI and gait analysis: A case study. J Neuroeng Rehabil 2014;11:1-2.
20. Morgan P, Embry A, Perry L, Holthaus K. Feasibility of lower-limb muscle power training to enhance locomotor function poststroke. J Rehabil Res Dev 2015;52:77.
21. Ouellette MM, LeBrasseur NK, Bean JF, Phillips E, Stein J, Frontera WR, *et al*. High-intensity resistance training improves muscle strength, self-reported function, and disability in long-term stroke survivors. Stroke 2004;35:1404-9.
22. Dickstein R. Rehabilitation of gait speed after stroke: A critical review of intervention approaches. Neurorehabil Neural Repair 2008;22:649-60.
23. Tschopp M, Sattelmayer MK, Hilfiker R. Is power training or conventional resistance training better for function in elderly persons? A meta-analysis. Age Ageing 2011;40:549-56.
24. Kawamori N, Haff GG. The optimal training load for the development of muscular power. J Strength Condition Res 2004;18:675-84.
25. Lewelt A, Krosschell KJ, Stoddard GJ, Weng C, Xue M, Marcus RL, *et al*. Resistance strength training exercise in children with spinal muscular atrophy. Muscle Nerve 2015;52:559-67.
26. Hunnicutt JL, Aaron SE, Embry AE, Cence B, Morgan P, Bowden MG, *et al*. The effects of POWER training in young and older adults after stroke. Stroke Res Treatment 2016;2016:7316250.
27. Swain DP, Brawner CA, American College of Sports Medicine. ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription. United States: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014.
28. Winstein CJ, Rose DK, Tan SM, Lewthwaite R, Chui HC, Azen SP. A randomized controlled comparison of upper-extremity rehabilitation strategies in acute stroke: A pilot study of immediate and long-term outcomes. Arch Phys Med Rehabil 2004;85:620-8.
29. Thielman GT, Dean CM, Gentile AM. Rehabilitation of reaching after stroke: Task-related training versus progressive resistive exercise. Arch Phys Med Rehabil 2004;85:1613-8.
30. Patten C, Dozono J, Schmidt SG, Jue ME, Lum PS. Combined functional task practice and dynamic high intensity resistance training promotes recovery of upper-extremity motor function in post-stroke hemiparesis: A case study. J Neurol Phys Ther 2006;30:99-115.
31. Corti M, McGuirk TE, Wu SS, Patten C. Differential effects of power training versus functional task practice on compensation and restoration of arm function after stroke. Neurorehabil Neural Repair 2012;26:842-54.
32. Patten C, Condliffe EG, Dairaghi CA, Lum PS. Concurrent neuromechanical and functional gains following upper-extremity power training post-stroke. J Neuroeng Rehabil 2013;10:1-9.
33. Porter MM. Power training for older adults. Appl Physiol Nutr Metab 2006;31:87-94.
34. Fielding RA, LeBrasseur NK, Cuoco A, Bean J, Mizer K, Singh MA. High-velocity resistance training increases skeletal muscle peak power in older women. J Am Geriatr Soc 2002;50:655-62.
35. Weier AT, Pearce AJ, Kidgell DJ. Strength training reduces intracortical inhibition. Acta Physiol 2012;206:109-19.
36. Lamberti N, Straudi S, Malagoni AM, Argirò M, Felisatti M, Nardini E, *et al*. Effects of low-intensity endurance and resistance training on mobility in chronic stroke survivors: A pilot randomized controlled study. Eur J Phys Rehabil Med 2016;53:228-39.
37. Kyröläinen H, Avela J, McBride JM, Koskinen S, Andersen JL, Sipilä S, *et al*. Effects of power training on muscle structure and neuromuscular performance. Scand J Med Sci Sports 2005;15:58-64.