COMPARISON OF THE EFFECT OF QIGONG EXERCISES AND VIRTUAL REALITY TRAINING ON IMPROVING UPPER LIMB MOTOR FUNCTION IN PATIENTS WITH SUB-ACUTE STROKE

[1]Nisha Anil Kuril, [2]Smita Mundhe
[1]Intern, Bachelor of Physiotherapy, [2]Guide
[12]Health Sciences
[12]Maharashtra Institute of Physiotherapy, Latur, Maharashtra, India

Abstract*—Background: Stroke frequently results in upper limb motor impairment, which can limit independence and participation in activities of daily living. Rehabilitation approaches such as Qigong exercises and Virtual Reality Training (VRT) may support motor recovery, but their comparative effects in patients with sub-acute stroke require further evaluation. Aim: To compare the effects of Qigong exercises and Virtual Reality Training on upper limb motor function in patients with sub-acute stroke. Methods: This comparative, two-group pre–post study included 22 patients with sub-acute stroke. Participants were allocated to a Virtual Reality Training group (VRT; n = 11) or a Qigong exercise group (QG; n = 11). The intervention period was four weeks. Upper limb motor function was assessed before and after the intervention using the Fugl-Meyer Assessment–Upper Extremity (FMA-UE). The affected-limb score was used for the primary analysis. Descriptive statistics, Shapiro–Wilk testing, within-group tests and between-group comparisons were performed. Results: Both groups improved. Mean affected-limb FMA-UE scores increased from 36.55 ± 8.65 to 43.45 ± 8.17 in the VRT group (mean change 6.91 points) and from 41.64 ± 8.23 to 45.45 ± 8.73 in the QG group (mean change 3.82 points). Within-group improvement was statistically significant in both groups. The between-group difference in change favoured VRT (mean difference 3.09 points, 95% CI 1.12–5.06; Mann–Whitney U = 111.5, p < .001). Conclusion: Both interventions were associated with improved upper limb motor function over four weeks. The VRT group demonstrated a significantly greater improvement in FMA-UE scores than the Qigong group in this sample. The findings should be interpreted cautiously because of the small sample and absence of long-term follow-up.

***Index Terms*—Sub-acute stroke; Qigong exercises; Virtual Reality Training; upper limb motor function; Fugl-Meyer Assessment**

I. Introduction

Stroke is a major cause of adult disability and may produce motor, sensory and functional impairments that interfere with independence. Upper limb dysfunction is particularly important because reaching, grasping, manipulation and coordinated arm movements are required for many everyday activities. The extent of impairment varies according to the site and severity of the cerebral lesion and the stage of recovery.

Neurological rehabilitation aims to restore, maximise or compensate for functional deficits following injury to the central nervous system. Repetitive, task-oriented practice and active participation are important elements of rehabilitation. Conventional physiotherapy remains central to stroke care, while complementary

approaches are being explored to increase engagement and provide additional opportunities for movement practice.

Virtual Reality Training uses computer-generated environments that allow users to interact with visual or simulated tasks. Depending on the equipment and programme, VR can provide repetitive practice, task-oriented activities and visual feedback. These features may encourage active participation and support motor learning. Previous research has reported potential benefits of VR-based rehabilitation for upper extremity motor recovery after stroke [1,2].

Qigong is a mind–body exercise approach involving controlled movements, breathing, concentration and body awareness. Its coordinated and gentle movements may provide a structured form of physical activity for selected stroke survivors. Literature has explored Qigong and related practices in stroke rehabilitation, including their potential effects on motor function and other health outcomes [3,4].

Although both approaches have potential therapeutic value, it is important to compare their effects using a defined clinical outcome. The present study therefore compared Qigong exercises and Virtual Reality Training for improving upper limb motor function in patients with sub-acute stroke, using the Fugl-Meyer Assessment–Upper Extremity as the outcome measure.

II. Materials and Methods

Study design and setting

The study used a comparative, two-arm pre–post intervention design and was conducted in the Neuro Physiotherapy outpatient department. The overall study duration was six months, and the intervention period was four weeks. The thesis describes a sample of 22 individuals, with 11 participants in each intervention group.

Participants

The study included patients diagnosed with sub-acute stroke. The inclusion criteria were: stroke (haemorrhagic or ischaemic) within the previous six months; receiving neurological physiotherapy; age between 18 and 55 years as specified in the eligibility criteria; active mobility in at least one upper limb; and ability to understand simple instructions. Exclusion criteria were neurodegenerative disorders such as Alzheimer's disease or Parkinson's disease, previous surgery on the limb being assessed, and scars restricting mobility.

The participant dataset included individuals aged 32–70 years. This differs from the stated 18–55-year eligibility range in the thesis. The manuscript reports the recorded dataset values and flags this discrepancy for verification before journal submission.

Interventions

Participants were divided into two groups: Group 1 received Virtual Reality Training (VRT; n = 11), and Group 2 performed Qigong exercises (QG; n = 11). Both interventions were delivered over four weeks. The thesis lists a VR headset, laptop, Fugl-Meyer scale, data sheet, Kinect 360 Xbox, Wi-Fi router and peg board among the study materials.

Outcome measure

Upper limb motor function was assessed using the Fugl-Meyer Assessment–Upper Extremity (FMA-UE). The thesis dataset records right- and left-sided scores before and after intervention. For the statistical

analysis, the score corresponding to the stroke-affected limb was used. The analysis section of the thesis describes the FMA-UE as a 0–66-point scale, with higher scores indicating better motor function.

Statistical analysis

Data were summarised using means, standard deviations, medians, interquartile ranges and ranges, as appropriate. The Shapiro–Wilk test was used to assess normality. Within-group change in the VRT group was analysed using the exact Wilcoxon signed-rank test because the change scores were non-normal; the QG group was analysed using a paired-samples t-test. Between-group change scores were compared primarily using the exact Mann–Whitney U test, with Welch's independent-samples t-test as a sensitivity analysis. A two-way mixed ANOVA (Group × Time) and an outlier-exclusion sensitivity analysis were also reported in the thesis. Statistical significance was set at $p < .05$.

III. Results

Participant characteristics

A total of 22 participants were included, with 11 in each group. The VRT group had a mean age of 47.00 ± 10.34 years and the QG group had a mean age of 55.09 ± 11.86 years. The VRT group included six males and five females, while the QG group included eight males and three females. The affected side was right in six participants and left in five participants in each group.

Characteristic	VRT (n = 11)	QG (n = 11)
Age, mean ± SD (years)	Age, mean ± SD (years)	47.00 ± 10.34
Age, median (IQR)	Age, median (IQR)	43 (41.5–52.5)
Age range (years)	Age range (years)	32–70
Male / Female, n	Male / Female, n	6 / 5
Affected side, right / left, n	Affected side, right / left, n	6 / 5

Table 1: Participant Characteristics

FMA-UE scores before and after intervention

Both groups demonstrated an increase in mean affected-limb FMA-UE scores after the four-week intervention. The VRT group improved by a mean of 6.91 points, while the QG group improved by a mean of 3.82 points.

FMA-UE affected-limb score	VRT (n = 11)	QG (n = 11)
Pre-intervention, mean ± SD	Pre-intervention, mean ± SD	36.55 ± 8.65
Post-intervention, mean ± SD	Post-intervention, mean ± SD	43.45 ± 8.17
Change (post − pre), mean ± SD	Change (post − pre), mean ± SD	6.91 ± 2.84
Change, median (IQR)	Change, median (IQR)	6 (5–7)
Change range	Change range	4–14

Table 2: FMA-UE Scores

Within-group analysis

The VRT group showed a statistically significant improvement (exact Wilcoxon signed-rank test: $W = 0$, $p = .001$; median improvement = 6 points; rank-biserial $r = 1.00$). The QG group also demonstrated a statistically significant improvement (paired t-test: $t(10) = 12.90$, $p < .0001$; mean improvement = 3.82 points; Cohen's $dz = 3.89$). All 22 participants showed an increase in their affected-limb FMA-UE score.

Between-group comparison

The primary between-group comparison showed a statistically significant difference in improvement, favouring VRT (Mann–Whitney $U = 111.5$, $p < .001$; rank-biserial $r = 0.843$). The mean difference in

improvement was 3.09 points (VRT minus QG), with a 95% confidence interval of 1.12 to 5.06. Welch's independent-samples t-test supported this finding (t(12.35) = 3.407, p = .005; Hedges' g = 1.398).

Analysis	Test result	p-value / estimate
VRT within-group	Wilcoxon signed-rank W = 0	p = .001
QG within-group	Paired t-test t(10) = 12.90	p < .0001
Between-group change	Mann–Whitney U = 111.5	p < .001
Welch sensitivity test	t(12.35) = 3.407	p = .005
Mean change difference	VRT − QG	3.09 points (95% CI 1.12–5.06)
Group × Time interaction	F(1,20) = 11.606	p = .003; partial η^2 = .367

The thesis also reports that the between-group difference remained statistically significant after excluding the high change-score observation in the VRT group (VRT n = 10; Mann–Whitney U = 100.5, p = .001; Welch's t = 3.905, p = .002).

IV. Discussion

The present study compared Qigong exercises and Virtual Reality Training for improving upper limb motor function in patients with sub-acute stroke. Both groups demonstrated statistically significant improvement in affected-limb FMA-UE scores after four weeks. However, the magnitude of improvement was greater in the VRT group than in the QG group, and the primary between-group comparison was statistically significant.

The VRT group improved by a mean of 6.91 points, increasing from 36.55 to 43.45, while the QG group improved by 3.82 points, increasing from 41.64 to 45.45. The mean difference in change was 3.09 points. This finding suggests that, under the conditions of the present study, VRT was associated with greater improvement in the measured upper limb motor outcome.

The interactive nature of VR-based rehabilitation may help explain the larger change observed in the VRT group. Virtual environments can provide repeated, goal-directed movement practice and visual feedback, which may encourage active participation and movement control. Previous work has described the potential role of VR and videogames as adjuncts to physiotherapy after stroke [1,2].

The Qigong group also showed improvement. Qigong combines controlled movement, breathing, concentration and body awareness. These features may support coordinated movement and active engagement in rehabilitation. Previous literature has examined Qigong and related mind–body exercise approaches in stroke populations and has reported potential benefits, although evidence varies across outcomes [3,4].

The baseline comparison did not show statistically significant differences in age, affected-limb FMA-UE score or gender distribution. However, the QG group was approximately eight years older on average. Although this difference was not statistically significant, age-related differences in recovery potential may be relevant when interpreting the results. In addition, the VRT change-score distribution was non-normal because of one high improvement value. The thesis addressed this by using non-parametric primary tests and repeating the between-group analysis after excluding that observation; the result remained significant.

The findings should not be interpreted as evidence that VRT can replace conventional physiotherapy.

Rather, VR may be considered an adjunct where equipment, supervision and patient suitability permit. Qigong may also be considered as a complementary exercise option according to the patient's abilities and rehabilitation goals.

V. Limitations and Future Research

The study had a small sample of 22 participants, which limits the generalisability of the findings. The intervention period was four weeks, and no long-term follow-up was performed. The FMA-UE was the principal outcome measure; additional measures of hand function, activity performance and activities of daily living were not reported. Individual differences in age, baseline motor function and recovery after stroke may also have influenced the results. The thesis additionally contains a discrepancy between the stated age eligibility range (18–55 years) and the recorded participant ages (32–70 years), which should be checked against the original records.

Future studies should recruit larger samples, extend the intervention and include follow-up assessments to determine whether improvements are maintained. Multiple outcome measures should be used to assess motor impairment, hand function and performance of daily activities. Further research may also evaluate combined programmes involving Qigong, VR and conventional physiotherapy, as well as the feasibility, safety, accessibility and cost-effectiveness of these interventions in routine clinical practice.

VI. Conclusion

Both Qigong exercises and Virtual Reality Training were associated with improved upper limb motor function over four weeks in patients with sub-acute stroke. The VRT group demonstrated a significantly greater improvement in FMA-UE scores than the Qigong group in this sample. The findings should be interpreted cautiously because of the small sample and absence of long-term follow-up. Larger, longer-term studies are warranted.

VII. Acknowledgment

The authors thank the participants and the Department of Neuro Physiotherapy, Maharashtra Institute of Physiotherapy, Latur for their support.

References

[1] G. Eason, B. Noble, and I. N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955.

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[5] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.