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Effectiveness of Graded Retro Walking on Gait and Quality of Life in Post Stroke Survivors.

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ABSTRACT

Background: *Individuals who have experienced a stroke frequently face a range of severe physical impairments, including muscle weakness, reduced co-ordination, difficulty in walking, and compromised fine motor skills. These physical limitations not only hinder their ability to perform everyday activities independently but also contribute to a profound sense of frustration and helplessness.*

Methods: *The present study is an experimental survey conducted in the Cardiorespiratory Physiotherapy Department of Krishna Hospital, Karad, after obtaining ethical clearance from Krishna Vishwa Vidyapeeth (Deemed to be University), Karad. A total of 30 participants were selected using simple random sampling. The study was carried out over a duration of six months and the treatment duration of 4 weeks.*

Result: *The experimental survey, conducted on Thirty post-stroke survivors using simple random sampling, showed a 32.08% improvement in DGI scores having the p-value in pre test is 0.0344 & in post test is > 0.10 therefore the final p-value: < 0.0001 and 27.56% improvement in SS-QOL scores having the p value in pre test is > 0.10 and in post test is > 0.10 therefore the final p-value: < 0.0001. These findings highlights the intervention's effectiveness in enhancing gait and overall quality of life.*

Conclusion: *Graded retro walking is a safe, affordable, and effective rehabilitation method for stroke patients. It enhances gait symmetry and improves quality of life. As a valuable addition to standard physiotherapy, it supports both physical and psychological recovery, making it a key component of comprehensive post-stroke rehabilitation.*

Key words*: Stroke, Graded Retro walking, Post stroke survivors, Dynamic gait index scale Stroke specific quality of life scale.*

INTRODUCTION:

A stroke is an abrupt interruption of blood flow to the brain, resulting in a decline in brain function. This interruption can be the result of either a blockage in an artery that supplies blood to the brain, commonly referred to as an ischemic stroke, or the result of a blood vessel rupture within the brain, referred to as a haemorrhagic stroke.[1] Stroke survivors are frequently deconditioned and predisposed to a sedentary lifestyle, which impairs performance in daily activities, increases the risk of falling, and may contribute to an increased risk of recurrent stroke and other cardiovascular disease. Cardiorespiratory impairment is a significant concern among post-stroke survivors, affecting their rehabilitation outcomes and long-term health. Studies estimate that up to 75% of stroke survivors experience reduced cardiorespiratory fitness (CRF), as measured by parameters like peak oxygen uptake (VO_2 max) and walking tests. These impairments arise due to physical inactivity, muscle deconditioning, and neuromuscular deficits. Prolonged immobility exacerbates cardiovascular health decline, further limiting physical activity and independence.[2]

Retro-walking or backward walking may improve cardio respiratory fitness and change body composition [3]. Walking, a low impact exercises places minimum stress and it is an moderate exercise for post stroke patients to perform. Walking helps to build the muscle endurance [4]. As the patients build the endurance breathing at rest or during activity will become easier and will increase exercise tolerance. The relaxation technique helps to improve the quality of life and also reduce the dyspnea, as well as improve their physical activity. Breathing exercises help people to breathe more effectively and efficiently [5].

It is a therapy that focuses on tightening and relaxing the muscle. The progressive muscle relaxation reduce anxiety and dyspnea as well as reduces intensity of pain, and relieve stress in patients with post stroke [6]. Doing the same fitness routine every day can feel boring after awhile. To prevent this, the study incorporating 10-20 minutes of backward walking with relaxation exercises provides with the workout variety to the mind and body crave [7].

For stroke survivors, rehabilitation is essential to enhancing functional outcomes and regaining their independence. The main focus of conventional therapy is on general strengthening, balance exercises, and forward walking. But compared to some conventional techniques, task-specific interventions like graded retro walking—a type of backward walking with increasing intensity—have the potential to improve lower limb strength, balance, and gait efficiency.[8].

Compared to forward walking, retro walking uses different muscle groups and necessitates more stability and posture control. It has been shown to lessen joint impact forces while more efficiently activating the tibialis anterior, hamstrings, and quadriceps (Flynn et al., 1994). This makes it an especially effective intervention for neurologically impaired populations, including stroke survivors, to improve muscle function and motor coordination.[9].

The use of graded retro-walking in patients with post stroke is to relieve dyspnea and anxiety level, still remains to be debated. Hence the study aims in contributing towards the "Effectiveness of Graded Retro Walking on gait and Quality of life in Post-Stroke survivors."

AIM: To study the Effect of Graded Retro walking on functional exercise capacity balance & quality of life in post stroke survivors.

OBJECTIVE:

1] To study the Effectiveness of Graded Retro Walking on Gait and Quality of life in Post-Stroke survivors.

2] To identify patients response and tolerance to evaluate levels of retro walking challenges (e.g., incline, surface variation).

NEED FOR STUDY :

Stroke frequently causes impaired respiratory function, decreased exercise capacity, and a low quality of life. While conventional rehabilitation focuses mainly on motor recovery, important aspects like breathing and psychological well-being are frequently overlooked. Graded retro walking improves balance, gait, and muscle strength, Stroke is a leading cause of long-term disability, often resulting in impaired respiratory function, reduced exercise capacity, and poor quality of life. Rehabilitation strategies like graded retro walking primarily target motor recovery, often neglecting crucial components such as respiratory efficiency and psychological well-being. While retro walking enhances balance, gait, and muscle strength, function and reduce anxiety. Despite the individual benefits of these interventions, there is limited evidence on their combined effect in stroke rehabilitation. Therefore, this study is needed to explore whether integrating these low-cost, non-invasive techniques can yield superior improvements in gait symmetry and overall quality of life in post-stroke patients.

METHOD:

Ethical Considerations

The present study is a Survey study carried out in Krishna Hospital, Karad after obtaining permission from the ethical committee of Krishna Vishwa Vidyapeeth (deemed to be university), Karad.

Research approach: experimental study. Sampling: Simple random sampling. Study setting: Cardiorespiratory Physiotherapy department, Krishna Hospital, Karad. Sample size: 30. Study duration: 6 months

Sample size: 30

The minimum members required for the study is calculated as follows:

FORMULA: $N = \frac{Z^2 .p.q}{L^2}$

Where :

n = required sample size

Z = standard normal deviate (typically 1.96 for 95% confidence)

p = estimated prevalence (in decimal) = 0.5

q = 1-p = 0.5

L = allowable error (in decimal, often taken as 5% or 0.05)

So, a prevalence (p) of 50%, 95% confidence level (Z = 1.96), and an allowable error (L) of 17.88 %, the calculated sample size was 30.

$$N = \frac{(1.96)^2 .(0.5).(0.5)}{(0.1788)^2} = 30$$

INCLUSION CRITERIA:
1] Age: 40 to 75 years **2] Cognition:** Mini-Mental State Examination (MMSE) score ≥ 24. **3] Mobility & Balance**: Able to walk 10 meters; Berg balance scale (BBS) score ≥ 21. **4] Medical Stability**: No recent cardiac events, uncontrolled hypertension, DVT, or fractures. **5] Consent:** Willing to provide written informed consent.

EXCLUSION CRITERIA:
1] Unstable cardiac disease. **2]** Presence of Musculoskeletal disorders. **3]** Cognitive/Communication Impairment: MMSE < 24. **4]** Severe Balance Disorders **5]** Psychiatric Illness **6]** Inability to complete exercise training **7]** Patient below the age of 40 years & above the age of 75 years.

ETHICAL COMMITTEE APPROVAL:
The study was approved by the institutional ethical committee of Krishna Vishwa Vidyapeeth (deemed to be a university) in Karad. Respondents were given an explanation of the study and forms, and they provided informed consent. All respondents volunteered to participate, and their confidentiality was maintained throughout the study.

PROCEDURE:
This study was conducted at the OPD of Krishna College of Physiotherapy, KVV, Karad. Permission was obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth, Karad. A sample size of 30 was calculated. The subjects were selected according to the inclusion and exclusion criteria. Patients with the age of 40-75 years, who were clinically diagnosed with stroke and willing to provide consent were included. Patients with pre-existing cardiorespiratory disorders not related to stroke, cognitive impairments interfering with communication, or those unwilling to provide consent were excluded. The nature of the study was explained to the subjects and written consent were obtained. Participants were educated about secondary consequences they may face post stroke such as decreased functional capacity and the respiratory symptoms. The study findings were interpreted based on the data collection sheet. the Effectiveness of Graded Retro Walking on Gait and Quality of life in Post-Stroke survivors.

RESULTS:
The experimental survey study was conducted using simple random sampling on Thirty post-stroke survivors. The participants, all of whom met the inclusion criteria, responded to questions administered by the therapist. The effectiveness of the proposed intervention was demonstrated by 32.08% improvement in DGI scores having the p-value in pre test is 0.0344 & in post test is > 0.10 therefore the final p-value: < 0.0001 and 27.56% improvement in SS-QOL scores having the p value in pre test is > 0.10 and in post test is > 0.10 therefore the final p-value: < 0.0001.. These results indicate a significant enhancement in both gait and quality of life, thereby validating the effectiveness of the intervention program in improving physical function and overall well-being.

STATISTICAL ANALYSIS :

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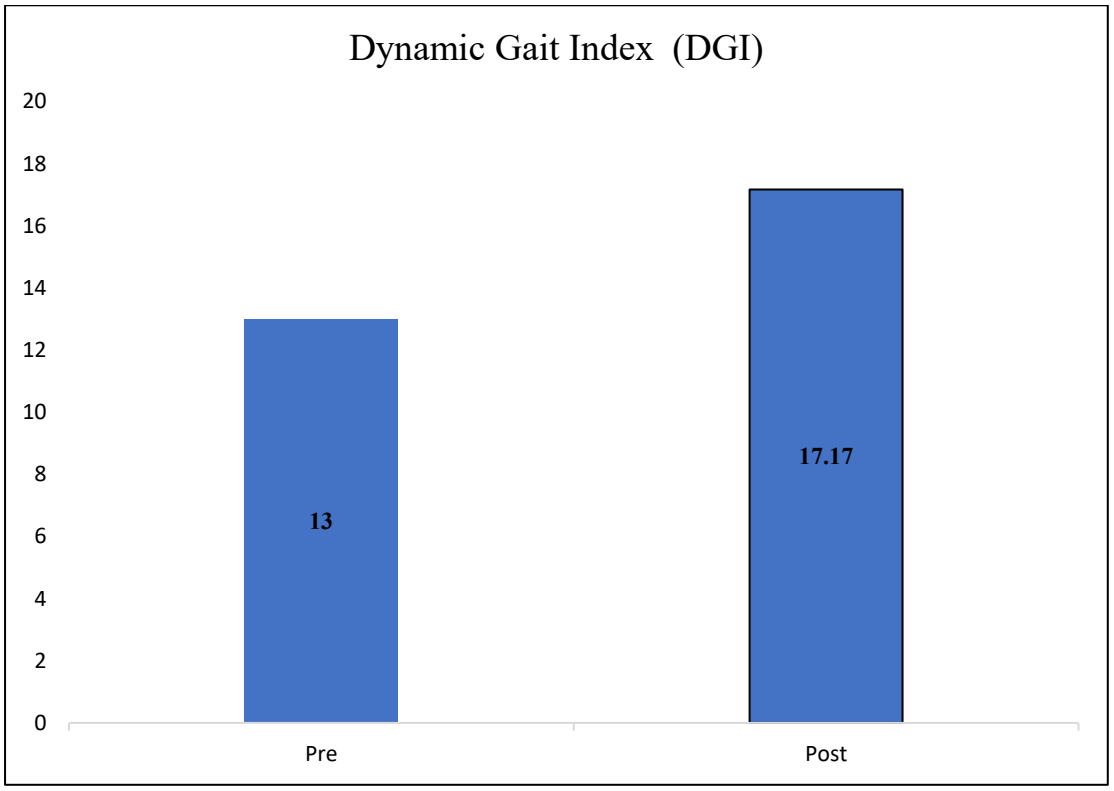
GRAPH NO. – 1



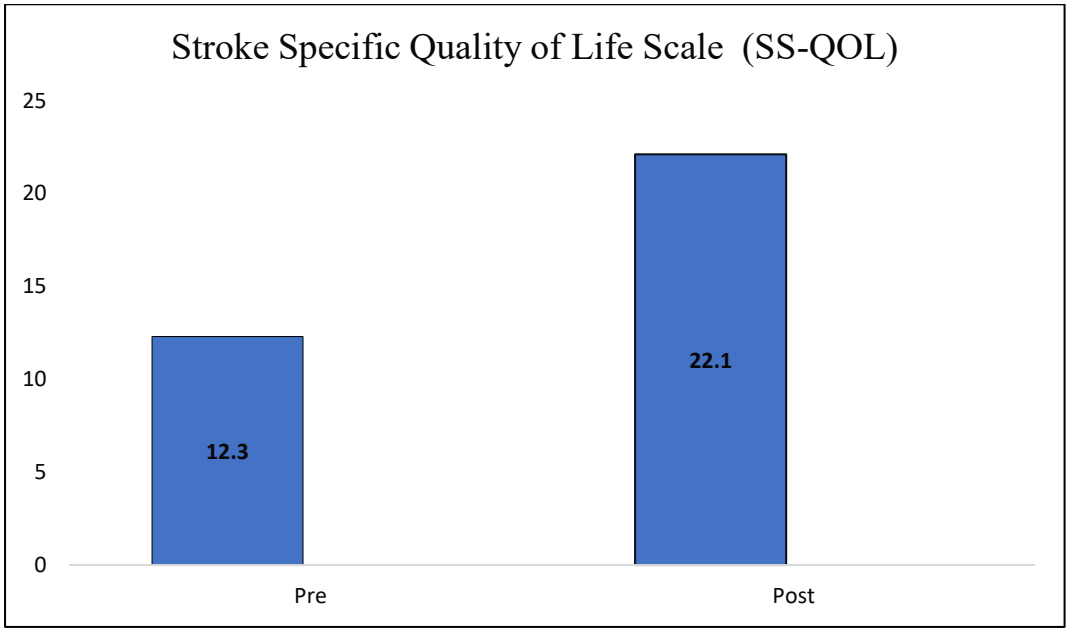
- **Pre-intervention score:** 13.00
- **Post-intervention score:** 17.17

Interpretation:

There is a notable improvement in DGI scores post-intervention, increasing by approximately 4 points. Enhanced overall well-being and perceived quality of life following the intervention. Positive changes in multiple stroke-specific domains such as mobility, mood, self-care, energy, and social participation.

Graded retro walking may have contributed to: **1]** Improved physical confidence **2]** Improved balance, gait **3]** Improved functional independence and mobility **4]** Better engagement in daily activities **5]** Reduced fall risk

GRAPH NO. – 2



- **Pre-intervention score:** 12.3
- **Post-intervention score:** 22.1

Interpretation:
There is a notable improvement in SS-QOL scores post-intervention, increasing by approximately 9.8 points. Enhanced overall well-being and perceived quality of life following the intervention. Positive changes in multiple stroke-specific domains such as mobility, mood, self-care, energy, and social participation.
Graded retro walking may have contributed to:
1] Improved physical confidence **2]** Increased independence **3]** Reduced anxiety/fear of falling **4]** Better engagement in daily activities
Interpretation:
The study found that graded retro walking training greatly enhanced post-stroke survivors quality of life and gait performance. Better functional ambulation, dynamic balance, and gait stability were reflected in enhanced Dynamic Gait Index (DGI) scores 32.08% improvement, especially in complex tasks like head turns, obstacle avoidance, and stair navigation. Furthermore, improvements in Stroke-Specific Quality of Life (SS-QOL) scores 27.56% improvements in the social, emotional, and physical domains participants reported improved self-care, mobility, participation, and mood. Graded retro walking is supported by these combined results as a thorough and successful rehabilitation technique. Following ethical approval from Krishna Vishwa Vidyapeeth "Deemed To Be University" Institutional Ethical Committee, the study was carried out.

DISCUSSION:
The purpose of this study was to assess the effects of retro walking on post-stroke patients' quality of life, functional exercise capacity. The results show statistically significant gains in each of the three areas, suggesting that these interventions could be useful supplements to routine physical therapy treatment. As a result of neuromuscular weakness, poor trunk control, and decreased physical activity, post-stroke patients frequently have impaired respiratory function. Retro walking, which works the postural and core muscles, probably increased diaphragmatic activation and thoracic mobility in this study. This theory is supported by the post-intervention improvements in forced vital capacity(FVC), respiratory rate, and peak expiratory flow rate(PEFR).
Prior research highlights the effect of trunk and core exercises on pulmonary function, as demonstrated by Lazarus et al. (2003). Deeper and more effective breathing patterns are encouraged by relaxation techniques that decrease sympathetic tone and increase parasympathetic activity, especially diaphragmatic breathing and progressive muscle relaxation. This is consistent with the respiratory variables noted improvements.
This study showed that post-stroke survivors Dynamic Gait Index (DGI) scores 32.08% improvement in DGI scores having the p-value in pre test is 0.0344 & in post test is > 0.10 therefore the final p-value: < 0.0001. significantly improved after graded retro walking, suggesting improved dynamic balance and gait adaptability. Improved postural responses during complex gait tasks were probably facilitated by the nature of retro walking, which calls for increased proprioceptive input and motor control. In neurological populations, especially stroke survivors, DGI is a validated tool for evaluating functional gait and fall risk (Shumway-Cook et al., 1997). Through increased confidence and independence in daily activities, graded retro walking may improve mobility and lower the risk of falls, as well as improve quality of life outcomes (Mohapatra et al., 2018).
In the intervention Stroke-Specific Quality of Life (SS-QOL) scores showed a 27.56% improvement in SS-QOL scores having the p value in pre test is > 0.10 and in post test is > 0.10 therefore the final p-value: < 0.0001. significant improvement, suggesting improved general health. Stroke survivors frequently experience cognitive, emotional, and physical aftereffects. Improved confidence, mobility independence, and a lower risk of falls all of which are highly connected with quality of life may have resulted from retro walking.
Sleep quality and emotional well-being, which are often compromised in stroke survivors, may have been enhanced by relaxation techniques, there found that 32.08% improvement in DGI scores having the p-value in pre test is 0.0344 & in post test is > 0.10 therefore the final p-value: < 0.0001 and 27.56% improvement in SS-QOL scores having the p value in pre test is > 0.10 and in post test is > 0.10 therefore the final p-value: < 0.0001. Particularly those that emphasize mindfulness and stress reduction. The inclusion of relaxation therapy for emotional and psychological rehabilitation in neurological conditions is supported by studies like that conducted by Chan et al. (2012).

This study found significant improvements in both the Dynamic Gait Index (DGI) and Stroke-Specific Quality of Life (SS-QOL) scores, indicating that graded retro walking improved gait, balance, and overall quality of life in post-stroke patients. DGI scores improved from 13.00 to 17.17 (increase in 4.17 points), indicating improved dynamic balance, gait adaptability, and functional mobility. These changes are linked to lower fall risk and better community ambulation. SS-QOL scores increased from 12.3 to 22.1 (increase in 9.8 points), with improvements in mobility, mood, self-care, energy, and social participation, indicating overall physical and psychosocial benefits.

This experimental group showed better results in every domain, This strengthens the synergistic effect of graded retro walking. The combination may have offered psychological and physical advantages that traditional therapy by itself was unable to fully provide.

Post-stroke patients quality of life, functional capacity, respiratory function, balance, and emotional well-being were all markedly enhanced by graded retro walking. This intervention decreased anxiety and fall risk while increasing confidence, mobility, and core strength. The results lend credence to its application as a successful supplement to conventional physical therapy for comprehensive stroke recovery.

CONCLUSION:

In the rehabilitation of stroke patients, graded retro walking has become a useful and scientifically supported intervention. It successfully targets important impairments like poor trunk control, impaired balance, asymmetrical gait, and decreased functional endurance by gradually increasing the challenge through stages, which range from supported to overground and incline retro walking. This type of therapy improves dynamic balance, coordination, and general mobility by activating the core muscles, strengthening the lower limbs, and stimulating the proprioceptive and vestibular systems. Additionally, compared to forward walking, retro walking specifically engages different muscle groups, improving gait symmetry and postural control—areas that are frequently impaired following a stroke.

In conclusion, graded retro walking is a practical, affordable, and simple method with many advantages. It ought to be regarded as an essential part of all-encompassing post-stroke physical therapy regimens that seek to re-establish both mental and physical capacity. The graded retro walking is a safe, flexible, and successful rehabilitation technique that helps stroke survivors deal with their mental and physical issues. It is a useful supplement for conventional physiotherapy protocols and can improve overall recovery, independence, and quality of life when included in post-stroke rehabilitation programs.

Limitations & recommendations:

One of the study's many drawbacks is its small sample size, which could restrict how accurately and broadly the result can be obtained. Longitudinal designs with bigger, more varied samples from several centres should be used in future research. Use of objective instruments such as spirometry is recommended. Deeper insights can be gained by stratifying data by type and severity of stroke, and the results should guide focused rehabilitation initiatives.

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