EFFECTS OF NONELASTIC PATELLAR TAPING ON STATIC AND DYNAMIC BALANCE IN INDIVIDUALS WITH CHRONIC STROKE: AN EXPERIMENTAL STUDY

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Abstract

Background

Chronic diseases such as diabetes mellitus, coronary heart disease, stroke, and chronic kidney disease have become increasingly prevalent due to factors like population aging and urbanization. These diseases impose significant social, health, and economic burdens globally. Despite this, knowledge about public awareness of such diseases and their associated risks remains insufficient.

Methodology:

A cross-sectional study was conducted involving 442 adults aged between 18 and 64 years, selected using multistage random sampling. The survey utilized a pre-tested, self-administered questionnaire to assess participants' knowledge about chronic diseases, lifestyle practices, and risk perception. Data were analysed using descriptive statistics and chi-square tests, with $p < 0.05$ considered statistically significant.

Results

The study revealed that while 61.8% of participants had heard of chronic diseases, detailed awareness of specific risk factors such as smoking, obesity, and hypertension was limited. Lifestyle practices contributing to chronic diseases were noted among the population, including a lack of physical activity and unhealthy dietary habits. Moreover, risk perception was suboptimal, with many participants underestimating their susceptibility to these conditions. Educational interventions were found to correlate positively with better awareness and healthier lifestyle choices.

Conclusions

This study highlights significant gaps in awareness and risk perception of chronic diseases among the surveyed population. There is a pressing need for targeted public health initiatives to enhance knowledge and promote preventive measures to reduce the burden of these conditions.

Keywords: Chronic diseases, diabetes mellitus, public awareness, risk factors, lifestyle practices, health education

INTRODUCTION

Stroke is a leading cause of death and disability in India, causing partial brain loss and functional disorders. Risk factors include hypertension, heart disease, tobacco use, and obesity. Stroke impacts individual functioning and rehabilitation potential, causing a double burden of communicable and non-communicable diseases in developing countries. [1-7]

Stroke affects the poor due to changing population exposure and high care costs, impoverishing families. Balance problems post-stroke lead to poor recovery and increased falls risk.[2,8]

Static balance involves maintaining postural stability and orientation with the center of mass over the support base at rest, while dynamic balance involves maintaining stability while in motion. Both involve reactive and proactive postural control. Stroke survivors often struggle with balance and postural control, particularly standing upright, due to asymmetric posture and abnormal body imbalance, which can hinder functional recovery, daily activities, and increased falls risk.[9,10]

Stroke patients often have altered weight distribution patterns, resulting in smaller excursions and reduced weight transfer through the weaker leg. This pattern is evident in all aspects of balance, including static and dynamic responses. Proprioceptive information from mechanoreceptors helps maintain dynamic stability and motor control. A decrease in proprioceptive sense can lead to decreased balance ability. Research shows a relationship between balance ability, gait speed, independence, and appearance.[8,11,12]

Stroke patients often experience tightness in their gastrocnemius and gluteus medius muscles, leading to abnormal pulling of the patellar tendon and patellar malalignment. Treatments like visual feedback training, dynamic balance control training, motor learning, task-oriented training, Tai-chi programs, and virtual-reality training are used to improve balance. Patellar taping, a method used to maintain positional faults, can also help reduce pain and aid in patient recovery. Maintaining patellar alignment is crucial for patient functional efficacy.[13,14,15]

Patellar taping realigns patellar location, improving tracking within the patellofemoral groove. McConnell's rehabilitation program includes patellar taping, stretching, and kinetic chain training. Balance assessment in stroke patients is evaluated using TUGT and SLS tests, with TUGT being reliable and valid and SLS being simple and low-cost.[15,16]

The aim of this research is to assess the impact of non-elastic patellar tape on both static and dynamic balance in individuals who have had a chronic stroke because there is insufficient data on this topic

MATERIALS & METHODS

The study used purposive sampling to select chronic stroke patients from an outpatient department over a year. Ethics approval was obtained, and the sample size was determined

using G*Power software. The primary outcome measure was the Timed Up and Go test, with a significance level of 0.05 and 80% power.

Inclusion and Exclusion Criteria

The study included patients aged 40 to 70 years with a first-ever supratentorial stroke of more than six months. Both male and female participants were eligible if they had a Mini-Mental State Examination (MMSE) score above 24, spasticity grade less than 3 on the Modified Ashworth Scale in the lower limb, and the ability to stand on one leg (on the affected side) and walk independently with or without support. Participants were also required to have a Q-angle exceeding 15 degrees for men and 20 degrees for women, as well as regular physiotherapy treatment. Patients were excluded if they had allergies to tape, lower limb fractures within the past year, replacement arthroplasty of either lower limb, cardiac disease, mental or movement disorders, hemiplegia due to traumatic brain injury, or if they were unwilling to participate. These criteria ensured a homogeneous and relevant sample for the study objectives.

Procedure

After obtaining ethical approval and written informed consent, participants meeting the inclusion criteria were selected. Pre-testing of static and dynamic balance was conducted using the Single-Leg Stance Test (eyes open and closed) and Timed Up and Go Test. McConnell taping was applied to the affected knee in a long-sitting position with 20-30° flexion. The patella was repositioned medially using stretch and non-elastic tape. After a 30-minute rest post-taping, balance tests were repeated for comparison. Follow-up assessment was performed after two days. The best of three trials for the Single-Leg Stance Test was recorded for analysis.

RESULTS

Data was analysed using SPSS version 20 and non-parametric Wilcoxon Signed Rank Test at baseline, 30 minutes, and 2 days post-intervention, with a 5% level of significance and 95% confidence interval.

Data was entered in Excel sheet and analysis was done using SPSS version 20. Before applying statistical tests data was screened for normal distribution.

Data was not normally distributed for outcome measures so, non parametric Wilcoxon Signed Rank Test was used for data analysis.

All the outcome measures were analyzed at baseline and at end of intervention after 30 minutes and 2 days after intervention using appropriate statistical tests. Data was analyzed at 5% level of significance with confidence interval (CI) at 95%.

Wilcoxon Signed Rank test was used for analysis of intervention group for pre and post test.

Wilcoxon Signed Rank test was used for analysis of intervention group for post and after 2 days test.

Wilcoxon Signed Rank test was used for analysis of intervention group in pre and after 2 days test.

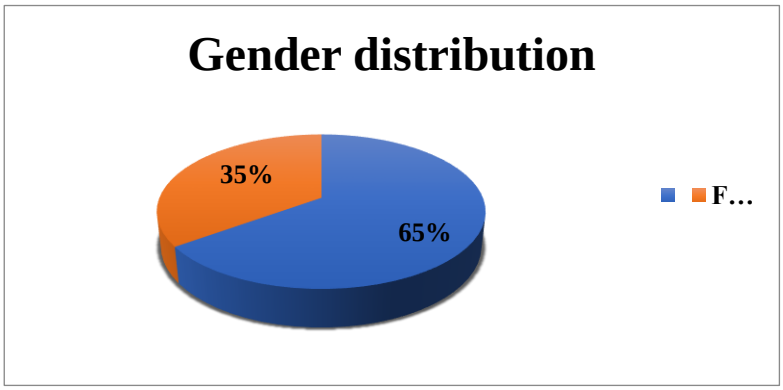
Baseline Data	Intervention group (n=40) n (%) or mean (SD)
Gender (Male/Female)	26/14 (65 /35)
Hemiplegic side (Right/Left)	17/23 (42.5/57.5)
Age(Y)	59.15 (8.90)

Mini- Mental State Examination score	27.97 (1.73)

Table 4: Demographic details of the subjects:

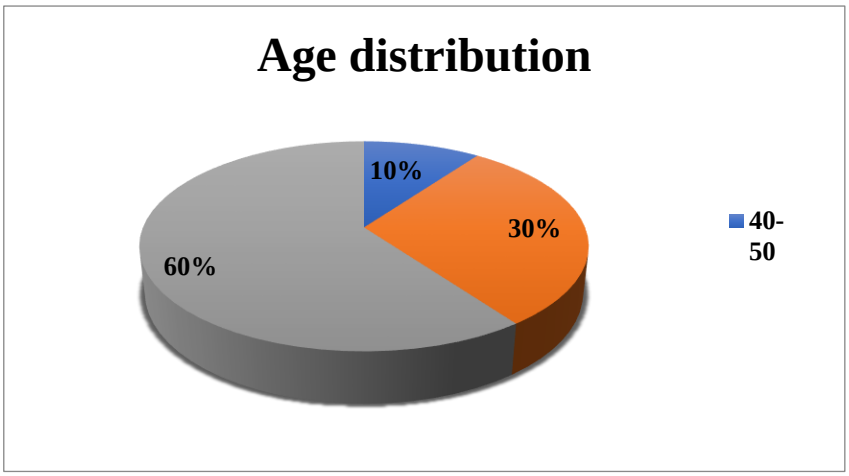
Table 4 : shows gender, hemiplegic side, age, MMSE distribution of 40 subjects included in the study.

Graph 1 - Gender distribution of Intervention group:



Graph 1: shows gender distribution of 40 subjects included in the study. There were 14 females and 26 males in the study.

Graph 2 - Age distribution of intervention group:



Graph 2 : shows age distribution of 40 subjects included in the study. There were 4 subjects between 40-50 years, 12 subjects between 50-60 years, and 24 subjects between 60-70 years.

Table 5 - Pre and Post Mean and SD of Intervention in SLST and TUGT

Outcome measures	Intervention group		W value	P value
	Pre test Mean ± SD	Post test Mean ± SD		
SLST eyes open(sec)	1.78 ± 0.64	3.15 ± 1.06	-5.511	0.000
SLST eyes close(sec)	0.74 ± 0.55	1.64 ± 0.60	-5.511	0.000
TUGT(sec)	26.49 ± 9.32	21.37 ± 8.89	-5.511	0.000

SLST-Single Leg Stance Test TUGT- Timed Up And Go Test

Interpretation: Wilcoxon Signed Rank Test was used for Pre and Post intervention comparison shown in table 5. The mean of SLST eyes open SLST eyes close and TUGT pre were 1.78, 0.74 and 26.49 respectively and post were 3.15, 1.64, and 21.37 respectively. In intervention group there was improvement in balance and this difference was statistically significant. ($p< 0.05$). The improvements in all the 3 outcome measures are clearly seen in the graph 3.

Graph 3-Pre and Post Mean difference of Intervention in SLST eyes open SLST eyes close and TUG

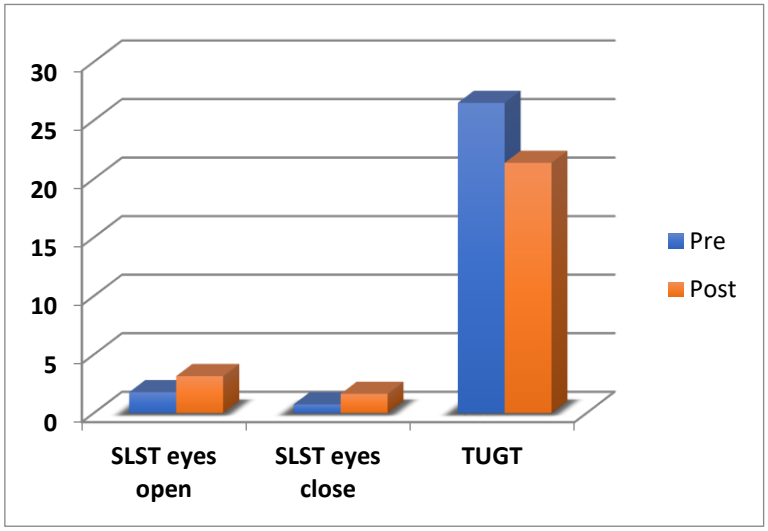


Table 6 - Post and After 2 days Mean and SD of intervention in SLST and TUGT

Outcome measures	Intervention group		W value	P value
	Post test Mean ± SD	After 2 days test Mean ± SD		
SLST eyes open (sec)	3.15 ± 1.06	3.39 ± 1.22	-4.956	0.000
SLST eyes Close (sec)	1.64 ± 0.60	1.82 ± 0.70	-4.295	0.000
TUGT (sec)	21.37 ± 8.89	21.22 ± 8.38	-0.659	0.510

Interpretation: Wilcoxon Signed Rank Test was used for Post and After 2 days test of intervention comparison shown in table .The mean of SLST eyes open SLST eyes close and TUGT pre were 3.15, 1.64 and 21.37 respectively and after 2 days were 3.39, 1.82 and 21.22 respectively. In intervention group there was improvement in balance and SLST eyes open

SLST eyes close. This difference was statistically significant. ($p< 0.05$). But there was not statistically significant difference in TUGT. This difference in outcome measures is clearly seen in the graph 4.

Graph 4- Post and After 2 days Mean difference of the intervention in SLST eyes open SLST eyes close and TUGT

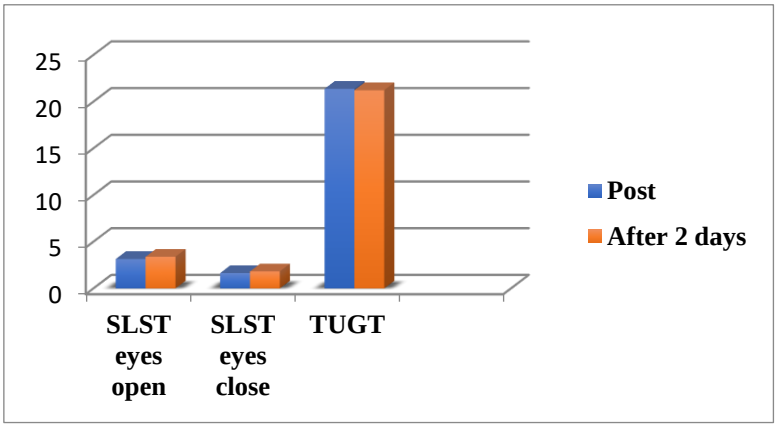
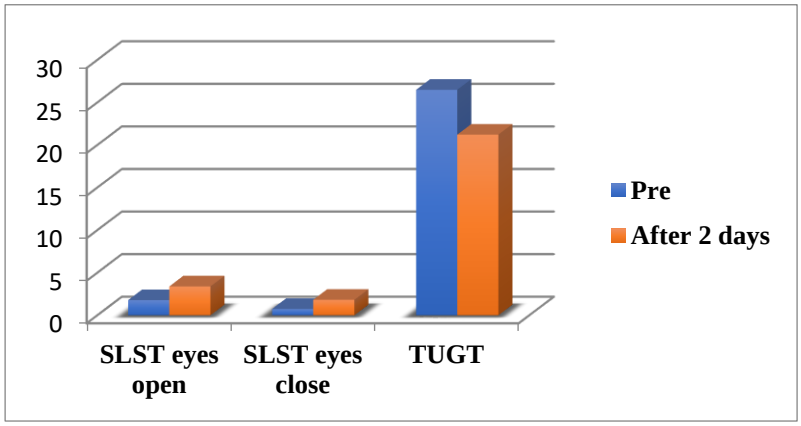


Table 7 - Pre and After 2 days Mean and SD of intervention in SLST and TUGT

Outcome measures	Intervention group		W value	P value
	Pre test Mean ± SD	After 2 days test Mean ± SD		
SLST eyes open (sec)	1.78 ± 0.64	3.39 ± 1.22	-5.511	0.000
SLST eyes close (sec)	0.74 ± 0.55	1.82 ± 0.70	-5.511	0.000
TUGT (sec)	26.49 ± 9.32	21.22 ± 8.38	-5.511	0.000

Interpretation: Wilcoxon Signed Rank Test was used for Pre and after 2 days intervention comparison shown in table 5. The mean of SLST eyes open SLST eyes close and TUGT pre were 1.78, 0.74 and 26.49 respectively and after 2 days were 3.39, 1.82 and 21.22 respectively. In intervention group there was improvement in balance and this difference was statistically significant. (P< 0.05). The improvements in all the 3 outcome measures are clearly seen in the graph 5.

Graph 5 - Pre and After 2 days Mean difference of the intervention in SLST eyes open, SLST eyes close and TUGT



DISCUSSION

This study was conducted to evaluate the effect of non - elastic patellar taping on static and dynamic balance in chronic stroke. Total 40 subjects were included in the study in one group.

Outcome measures used in this study were single leg stance test and timed up and go test. To assess static balance single leg stance test and to asses dynamic balance Timed up and go test

was used before starting the treatment, immediately 30 minutes after completing the treatment and follow up was taken after 2 days .

Out of 40 Subjects 14 were females and 26 were males. In the present study subjects were recruited according to age, MMSE, gender, and side of affection matched. Mean age of the group was 59.15 years, mean MMSE score of the group is 27.97, males were more compared to females and left side affection is more compared to right side.

Stroke patients show decreased motor function accompanied with sensory deficit, causing difficulties with posture control and place more weight on the unaffected side than on the affected side .[17,18] The decreased motor function not only reduces the quality of life but also leads to the loss of independence.[19] In addition, impaired proprioception, and muscle weakness reduce the ability to maintain balance .[20]

The reduced balance hinders recovery of ADL and motor functions as well as interferes with regaining independent gait by inducing sensory deficit.[8] Thus, the ability to control balance is an important component required for performing ADL, and restoration of balance control is a fundamental goal of rehabilitation of stroke patients.[21]

Non - elastic Taping, stabilizes muscles and joints, is widely used to correct muscle imbalance and unstable posture, thus improving balance control. Taping also prevents secondary injury of joints and muscles as well as reduces treatment duration by compensating the skin and ligaments.[22] McConnell patellar taping method is used to maintain positional fault corrected by repositioning. The application of patellar taping enhances joint position sense and proprioception through skin, tendon, and muscle stimulation. This process reduces pain and helps assists in patient recovery.[23] In the present study the effect of non - elastic patellar taping on static and dynamic balance was evaluated.

The first objective of this study was to study effect of non - elastic patellar taping on static balance by single leg stance test.

SINGLE LEG STANCE TEST:

The present study has used single leg stance test (with eyes open and eyes closed) to evaluate the static balance in chronic stroke. The reliability of this test is (ICC= 0.88 for the non-paretic limb and 0.92 for the paretic lower limb) [24]

The mean baseline value for SLST eyes open was 1.78 ± 0.64 and immediate 30 minutes after taping the mean value of SLST among participants is 3.15 ± 1.06 and after 2 days the mean value is 3.39 ± 1.22. The present study shows mean single stance time (sec) (with eyes open) ($P<0.05$) was highly significant between pre and post treatment session, post and after 2 days and pre and after 2 days.

The mean baseline value for SLST close was 0.74 ± 0.55 and immediate 30 minutes after taping the mean value of SLST among participants is 1.64 ± 0.60 and after 2 days the mean value is 3.39 ± 1.22. The present study shows mean single stance time (sec) (eyes closed position) ($P<0.05$) was highly significant between pre and post treatment session, post and after 2 days and pre and after 2 days

Non - elastic patellar tapes are used to compress the body parts, fix the joints, and restrict movable range. For instance, these tapes can be used directly to prevent excessive inversion of the ankle. Non - elastic patellar tapes can offer sufficient assistance and support. According to existing studies related to non - elastic tapes, these types of tapes can enhance mechanical stability by assisting and supporting functional movements of the body.[25]

Non - elastic patellar taping application contributed to the optimal joint alignment of the affected side during weight bearing and the controlling of the muscle strength and the action of the muscular system, which decreased joint instability and corrected musculoskeletal asymmetry through mutual deterrence.[26] This can lead to improvement in single leg stance time in the present study.

Youn-Bum Sung et al. in 2017 conducted a study Effects of taping and proprioceptive neuromuscular facilitation for stance phase duration of stroke patients concluded that kinesio taping and McConnell taping have showed a significantly longer stance phase duration of the affected side than the control group.[26]

The second objective of this study was to study the effect of non - elastic patellar taping on dynamic balance by timed up and go test.

TIMED UP AND GO TEST:

The present study has used Timed up and go test to evaluate the dynamic balance in chronic stroke. The reliability of this test is (ICC= 0.98)[27]

The mean baseline value for TUGT was 26.49 ± 9.32 and after taping the mean value of TUGT among participants is 21.37 ± 8.89 and after 2 days the mean value is 21.22 ± 8.38. The present study shows mean Time up and go test ($P<0.05$) was highly significant between pre and post treatment session and pre and after 2 days, but there was no significant difference in post and after 2 days mean.

Non-elastic patellar taping improves the alignment of the lower extremity, thus enhancing their balance ability and physical posture with decreased pain. Usage of patellar taping created pressure on joints, thus providing stability. This re-alignment of the patella and increased stability of the joint region led to improvement in dynamic balance ability.[25]

Jin Shin et al. conducted a study in 2014 the immediate effects of patellar taping on balance and gait ability in individuals with chronic stroke has shown that application of patellar taping in chronic stroke patients significantly improved dynamic standing balance ability and gait ability in these patients. Patellar taping re-positions the patella and aligns the symmetry of it, leading to rise in stability and dynamic balance ability.[24]

Jung-Ho Lee conducted a study in 2017, 2-dimensional analysis of low limb taping methods on ambulation for stroke patients has shown that kinesiotaping and McConnell showed a significantly longer stride length on the affected side than the control group. These results can be attributed to the fact that the taping applied before the therapy contributed to the improvement of the balancing sense of joint stability while activating the muscles during walking.[28]

Collaghan et al. in 2002 investigated the effect of patellar taping on knee joint proprioception and found that in those with poor proprioceptive ability, taping provided enhancement of proprioception.[29] Thus from this in present study also we can say that increase in proprioceptive feedback of balancing sense of joint stability due to patellar taping leads to improvement in balance.

In knee osteoarthritic patients Pfeiffer et al. in 2004 reported that the McConnell patellar-taping program is intended to correct patellar tracking by medializing the patella, allowing patients to engage in physical therapy exercise. Patellar taping improves patellar tracking in the patellofemoral groove and not in simple fixation of muscle in clinical settings. This improvement has a positive effect on the patient's gait without pain, re-aligning complete range of motion of these patients.[29]

Ernst et al. showed that patellar taping on knee joint improved the alignment of the patella and stability of knee joints. Also, patella taping brought beneficial effects on balance ability of knee joint and function of lower extremity.[30]

Chan-Woo nam et al. conducted a study in 2015, The effect of non - elastic taping on balance and gait function in patients with stroke and stated that application of non - elastic tape stabilized the joints of the lower extremities, thereby increasing balance.[31]

In clinical use or in general use, treatment choice depends on factors including practical use, accessibility and efficacy. Non - elastic patellar taping is safe and effective treatment for improving static and dynamic balance in chronic stroke patients.

CONCLUSION

A study on chronic stroke patients found that non-elastic patellar taping significantly improved both static and dynamic balance. The study involved 40 participants and showed significant improvements in SLST and TUGT performance. The findings suggest that non-elastic patellar taping could be a therapeutic approach to address balance deficits in this population. However, sustained intervention may be needed for sustained effects, and further research is needed to optimize taping protocols.

LIMITATIONS OF THE STUDY:

1. Long term follow up after cessation of intervention was not taken.
2. Placebo effects of the patients were not considered in this study.
3. There is no control group in this study.

FUTURE RECOMMENDATIONS:

1. Long-term effects of taping are currently unknown so future studies can be done on it.

2. Effect of patellar taping combined with other treatment techniques can be studied.
3. Comparison study of patellar taping with other taping techniques can be done.
4. Effect of patellar taping in sub - acute stroke patients can be done.

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