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The Effect of Achilles Tendon Vibration and Proprioceptive Neuromuscular Facilitation on Gait Performance in Ambulatory Stroke Patients

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Abstract

***Introduction:** Stroke was a leading cause of mortality and morbidity in both developed and developing countries like Bangladesh.*

***Objective:** To determine the effect of Achilles tendon vibration and Proprioceptive neuromuscular facilitation (PNF) exercise on gait performance in ambulatory stroke patients.*

***Materials and Methods:** It was a retrospective study which was conducted to determine the effect of Achilles tendon vibration and Proprioceptive neuromuscular facilitation (PNF) on gait performance in ambulatory stroke patients. Sample size of 40 were recruited in this study and divided into two groups (group-1 & group-2) with equal number of patients. Group-1 patients were treated by Achilles tendon vibration & group-2 patients were treated by Proprioceptive neuromuscular facilitation (PNF) exercise from 6 to 8 weeks with a frequency of 4 to 6 sessions per week. Functional outcome was measured by Wisconsin Gait Scale before and after the treatment. Purposive sampling technique was used for sample selection. A pre tested semi structured questionnaire was used as data collection instrument.*

***Results:** The mean age of the respondents were 54.00 ± 1.148 years with a range from 30 to 70 years in group-1 & 52.55 ± 9.682 years with a range from 40 to 66 years in group-2. The mean Wisconsin Gait score were 26.50 before treatment & 24.50 score after treatment in group-1. The mean Wisconsin Gait score were 28.60 before treatment & 26.10 scores after treatment in group-2. This study found that Wisconsin gait scores were lower in both groups after the treatments compare than before treatment that suggesting higher gait performance in ambulatory stroke patients. There is a significant (P<0.05) effect of Achilles Tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercise on gait performance in ambulatory stroke patients.*

Conclusion: Achilles tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercise both are statistically sound on gait performance in ambulatory stroke patients that was measured by Wisconsin Gait Scale.

Keywords: *Achilles tendon vibrations, Proprioceptive neuromuscular facilitation (PNF) exercise, Stroke, Gait and Wisconsin Gait Scale.*

Introduction

Stroke was a leading cause of mortality and morbidity in both developed[1-2] and developing countries like Bangladesh.[3-7] It was the leading cause of morbidity & disability in the Asian population.[7-11] Higher burden and mortality is in low and middle income countries because of stroke and it is increasing eventually.[12-15] More than 25% of Bangladeshi populations live below the poverty line.[16] Bangladesh was the third biggest country among south Asian countries with a population of 160 billion.[17] In developed countries there are many ways for early diagnosis and appropriate management which help to reduce stroke related mortality and morbidity. But the situation is different in developing countries like Bangladesh.[5] As a result, a probable annual financial burden occurred due to residual disability. Residual muscle weakness, balance problem, abnormal movement pattern and spasticity result in altered gait patterns. These residual problems of the stroke survivor lead to limit the individual functional activities of daily living.[18] The objective of this study was to find out the effect of Achilles tendon vibration and Proprioceptive neuromuscular facilitation (PNF) exercise on gait performance in ambulatory stroke patients.

Materials and Methods

It was a retrospective study which was conducted to determine the effect of Achilles tendon vibration and Proprioceptive neuromuscular facilitation (PNF) on gait performance in ambulatory stroke patients. Ambulatory stroke patients with sample size of 40 were recruited in this study and divided into two groups (group 1 & group 2) with equal number of patients. Group 1 patients were treated by Achilles tendon vibration from 6 to 8 weeks with a frequency of 4 to 6 sessions per week & group 2 patients were treated by Proprioceptive neuromuscular facilitation (PNF) technique from 6 to 8 weeks with a frequency of 4 to 6 sessions per week. Functional outcome was assessed by Wisconsin Gait Scale before and after the intervention. Patients were followed up in the outpatient department of the Physiotherapy Department at Ibn Sina Hospital & Diagnostic Centre (FK Unit), kallaynpur Dhaka. Non randomized purposive sampling technique was used for sample selection. Only ambulatory stroke patients with first-time stroke and both male & female respondents between the age of 30 and 70 years were included in the study. Patients having recurrent stroke, aphasia, severe cardiac illness (myocardial infarction), fracture, pregnancy were excluded in this study. A pre tested semi structured questionnaire, Wisconsin Gait Scale, digital weight machine & measuring tape was used as data collection instrument. After data collection, data was stored & quality control check was performed. Statistical package of Social Science (SPSS), version 16 was used for data analysis. After data collection, data was stored & quality control checked was performed. Data analysis was done according to the objectives of the study. P-value less than 0.05 were considered significant.

The Wisconsin Gait Scale (WGS) was used to evaluate the gait problems experienced by a patient with hemiplegia following stroke. This can be used to monitor the effectiveness of rehabilitation training. The tool is comprised of 14 items that measure clinically relevant temporal and distance gait parameters and kinematics that are frequently altered after a stroke. A total summative score which can be ranged from 13.35 to 42.0 was calculated for the items. The minimum score was 13.35 & maximum score was 42. The higher score, the more seriously affected the gait & lower score indicate better gait performance.[31]

Results

This study revealed that age group of 30-45 years, 46-60 years and above 60 years was 25%, 55% and 20% respondents respectively (Group 1) & age group of 30-45 years, 46-60 years and above 60 years was 40%, 30% and 30 % respondents respectively (Group 2). The mean age of the respondents were 54.00 ± 1.148 years with a range from 30 to 70 years (Group 1) & 52.55 ± 9.682 years with a range from 40 to 66 years (Group 2). The mean age & length of the age was higher in Group 1 compare with Group 2 (Table 1).

Table1. *Distribution of respondents by age (n=40)*

Age in years	Achilles tendon vibration (Group 1, n= 20)		Proprioceptive Neuromuscular Facilitation (PNF) exercise (Group 2, n=20)	
	Frequency	Percentage	Frequency	Percentage
30-45	5	25	8	40
46-60	11	55	6	30
>60	4	20	6	30
Total	20	100	20	100
Mean ± SD	54.00 ± 1.148		52.55 ± 9.682	

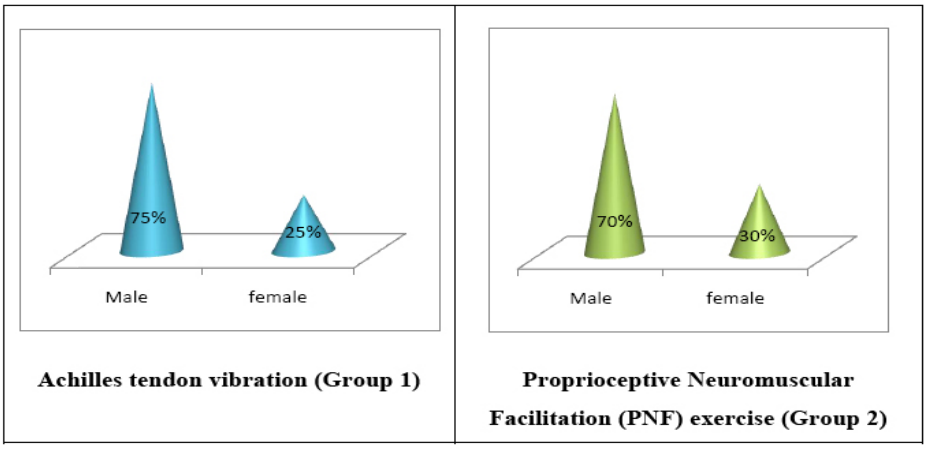

Fig1. *Distribution of respondents by sex (n=40)*

Male & female respondents were 75% & 25% in group-1 and male & female respondents were 70% & 30% in group-2 respectively. Male respondents were higher in both groups (Figure 1).

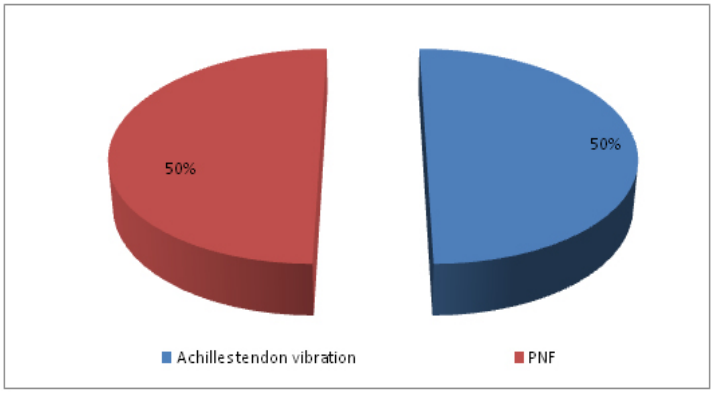

Fig2. *Distribution of respondents by type of treatment (n=40)*

Figure 2 showed that 50% of the respondent (n=20) was treated by Achilles tendon vibration (group 1) & other 50% of the respondent (n=20) was treated by Proprioceptive Neuromuscular Facilitation (PNF) exercise (Group 2).

Tables 2 showed that majority of the respondent (60%) were found from 21 to 30 scores followed by > 30 scores (Group 1) & highest respondents (70%) were found from 21 to 30 scores (Group 2) among ambulatory stroke patients before treatment. The mean Wisconsin Gait score were 26.55 ± 5.889 with a range from 17 to 37 scores in group-1 & 28.60 ± 2.907 with a range from 21 to 34 scores in group-2 before treatment.

Table2. *Distribution of respondents by Wisconsin Gait Scale (Before treatment) (n=40)*

Wisconsin Gait Scale (Point/ Score)	Achilles tendon vibration (Group 1)		Proprioceptive Neuromuscular Facilitation (PNF) exercise (Group 2)	
	Frequency	Percentage	Frequency	Percentage
<20 points	4	20	0	0
21-30 point	12	60	14	70
>30 points	4	20	6	30
Total	20	100	20	100
Mean ± SD	26.55 ± 5.889		28.60 ± 2.909	

Table3. *Distribution of respondents by Wisconsin Gait Scale (After treatment) (n=40)*

Wisconsin Gait Scale (Score/ point)	Achilles tendon vibration (Group 1)		Proprioceptive Neuromuscular Facilitation (PNF) exercise (Group 2)	
	Frequency	Percentage	Frequency	Percentage
<20	5	25	1	5
21-30	13	65	18	90
>30	2	10	1	5
Total	20	100	20	100
Mean ± SD	24.50 ± 5.753		26.10 ± 2.936	

Tables 3 showed that majority of the respondent were found from 21 to 30 scores followed by < 20 scores among ambulatory stroke patients after treatment (Group 1 & group 2). The mean Wisconsin Gait score were 24.50±5.753 with a range from 16 to 37 points in group-1 & 26.10 ±2.936 with a range from 19 to 31 points in group-2 after treatment.

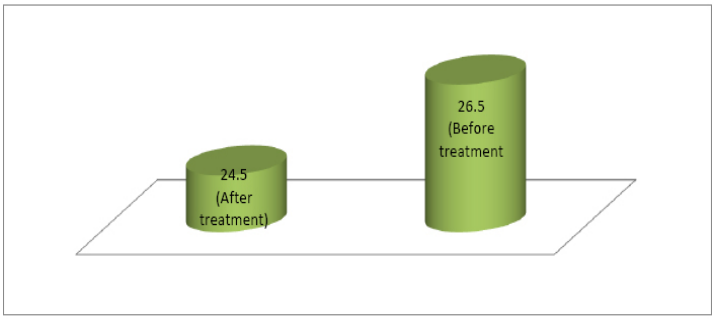

Fig3. *Distribution of respondents by mean Wisconsin Gait Score between before & after treatment (Group 1)*

Figure 3 showed that the mean Wisconsin Gait score were 26.50 before treatment & 24.50 score after treatment. This study found that Wisconsin gait scores were lower in group-1 after the treatments compare than before treatment that suggesting higher gait performance in ambulatory stroke patients. According to Wisconsin Gait Scale, Lower score suggesting higher gait performance.

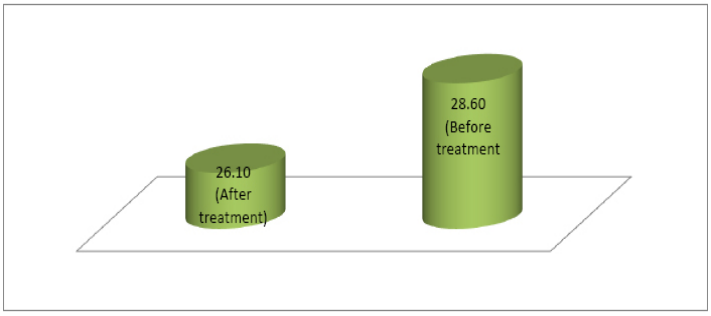

Fig4. *Distribution of respondents by mean Wisconsin Gait Score between before & after treatment (Group 2)*

Figure 4 showed that the mean Wisconsin Gait score were 28.60 before treatment & 26.10 score after treatment. This study found that Wisconsin gait scores were lower in group-2 after the treatments compare than before treatment that suggesting higher gait performance in ambulatory stroke patients. According to Wisconsin Gait Scale, Lower score suggesting higher gait performance.

Table 4 showed that t-value was 5.832 which were greater than tabulated t-value (2.845) & p-value was < 0.05 that was statistically significant findings which was measured by Wisconsin Gait Scale (group 1) & t-value was 9.747 which were greater than tabulated t-value (2.845) & p-value was < 0.05 that was statistically significant findings which was measured by Wisconsin Gait Scale (group 2). There is a significant effect of both Achilles Tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercise on gait performance in ambulatory stroke patients.

Table4. *Distribution of respondents between group 1 & group 2 (by paired t- test)*

Study group	Mean of Wisconsin gait score		t-Value	P- value
Achilles tendon vibration (Group 1)	Before treatment	After treatment	5.832	0.000
	26.55 ± 5.889	24.50 ± 5.75		
Proprioceptive Neuromuscular Facilitation (PNF) technique (Group 2)	Pre test	Post test	9.747	0.000
	28.60 ± 2.909	26.10 ± 2.936		

Discussion

This study was conducted to find out the effects of Achilles tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercises on gait performance in ambulatory stroke patients. Study found that majority of the respondents was with the age group from 46 to 60 years in group 1. Similar findings have been supported to the finds of previous study.[19,20,21] Study found that highest respondents were with the age group from 30 to 45 years in group-2. Different findings have been carried out to the finds of previous study.[22,23,26] The mean age of the respondents were 54.00 ± 1.148 years with a range from 30 to 70 years in group 1 & 52.55 ± 9.682 years with a range from 40 to 66 years in group 2. In the previous study carried out that the mean age of the hemiplegic patients were 68 years ranging in age from 42 to 87 years,[22] mean age were 59.30 years,[23] mean age were 60 years[24] & mean age were 62 years.[25] Another study carried out that the mean age for male & female stroke patients were 66 years & 70 years respectively.[26] Study showed that male & female respondents were 75% & 25% respectively in group-1 and male & female respondents were 70% & 30% respectively in group-2. Male respondents were higher in both groups. Similar findings have been highlighted in many previous studies.[6, 22, 27] Study showed that the mean Wisconsin Gait score were 26.50 before treatment & 24.50 score after treatment by Achilles tendon vibration. Study showed that the mean Wisconsin Gait score were 28.60 before treatment & 26.10 score after treatment by Proprioceptive neuromuscular facilitation (PNF) exercises. Study showed that t-value was 5.832 which were greater than tabulated t-value (2.845) & p- value was < 0.05 that was statistically significant findings which was measured by Wisconsin Gait Scale (Group 1) & t-value was 9.747 which were greater than tabulated t-value (2.845) & p- value was < 0.05 that was statistically significant findings which was measured by Wisconsin Gait Scale (Group 2). Similar findings have been supported to the finds of previous study of Pizzi A, et.al.[22] & Rodriquez AA, et. al. editors.[28] Similar findings have been supported to the finds of previous study of Kim Y.et.al editors[29] who reported that there was a significance effect (P<0.05) of Proprioceptive neuromuscular facilitation (PNF) exercises on gait performance in stroke patients. This study was correlated with the findings of previous study of Lee MK, et al.[30] & Jeong WS, et al. editors[32] who found that using Proprioceptive neuromuscular facilitation (PNF) exercises improved the balance & gait performance of stroke patients.

Conclusion

The findings of the study is concluded that both Achilles tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercise is statistically sound & effective on gait performance in ambulatory stroke patients that measured by Wisconsin Gait Scale.

Need to attention of researchers all over the world. Further study should be needed to evaluate the effect of both Achilles tendon vibration & Proprioceptive neuromuscular facilitation (PNF) exercise on gait performance in ambulatory stroke patients.

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