Effect of Xingnao Kaiqiao (Brain Awakening through Opening Orifices) Acupuncture Method in Restoring Lower Limb Muscle Strength & Functions in Individuals with Acute Stroke

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ARTICLE INFO
Article History
Submitted: 25 May, 2023
Accepted: 15 June, 2023
Published: 8 August, 2023

Source of support: None
Conflict of Interest: None

ABSTRACT

Introduction: Stroke is a major cause of disability in adults worldwide. "Xingnao Kaiqiao" XNKQ or "awakening brain and opening orifices" acupuncture method is a therapeutic principle and acupuncture method for the basic pathogenesis of stroke. Yin and Du meridian acupoints are the main acupoints, and the quantitative norms of needling manipulation are emphasized, which are different from the traditional methods of Acupuncture. The main purpose of this study was to explore the effect of Xingnao Kaiqiao Acupuncture Method on recovery of lower limb muscle function in patients with acute stroke.

Methods: It was a prospective, single blinded randomized controlled trial. Fifty patients with acute stroke and hemiplegia who met the diagnostic criteria were randomly divided into treatment group and control group with 25 cases in each group. The main acupoints used were Renzhong (DU 26), Neiguan (PC 6), Jiquan (HT 1), Chize (LU5), Weizhong (BL 40) and Sanyinjiao (SP 6). The differences between the two groups before and after treatment were compared, with statistical significance set at p-value less than < 0.05.

Results: In our study, the mean age in intervention group was 55.68±14.23 years and in and control group it was 56.32±12.03 years. After intervention there was significant improvement in MTS, MMT, FMA-LE and MRS within and between groups (p=0.001). Difference in differences was evaluated and there was significant difference in intervention group after the end of session in each variable (MTS: p=0.001, MMT: p= 0.03, FMA-LE: p=0.021 and MRS: p=0.001).

Conclusion: XNKQ Acupuncture method can significantly improve lower limb muscle strength and motor function in patients with acute stroke which is safe, low-cost, highly acceptable and effective treatment in Stroke

Keywords: Acupuncture; Acute stroke; Xingnao Kaiqiao Acupuncture.

INTRODUCTION

Stroke is a neurological deficit belonging to an acute focal injury of the central nervous system by a cause including cerebral infarction that results to brain, spinal cord, or retinal cell death, intracerebral hemorrhage, and subarachnoid hemorrhage.[1] According to the disease burden and mortality estimation of the World Health Organization, the cause-specific disability adjusted life year (DALys), years of life lost (YLL) and years lost due to disability (LDD) due to stroke is in increasing pattern from 2010 to 2016(WHO).[2] Xingnao Kaiqiao Acupuncture Method (XNKQ), that means “awakening mind and opening orifices”, is a set of acupuncture point combination and well-recognized technique in China developed by Academician Dr. Shi Xuemin and his associates for treating patients with stroke, traumatic brain injury (TBI) and neurological disorders.[3] Recent randomized control trial conducted in Mainland China, clinical experience and some animal studies have shown that XAM is significantly effective and safe in acute ischemic stroke management.[4-7] The "awakening brain and opening orifices" acupuncture method is a therapeutic principle and acupuncture method for the basic pathogenesis

of stroke, which is caused by blood stasis, liver wind, phlegm turbidity and other pathological factors masking brain orifice and "closing the orifice and concealing the spirit without leading the qi". In selecting acupoints, Yin meridian and Du meridian are the main points and the quantitative norms of needling manipulation are emphasized, which are different from the traditional methods of selecting acupoints and needling. The method of "awakening the brain and opening the orifices" is based on the theory of "Brain is the residence of Spirit". It emphasizes that the key to the emergence of all diseases is "the spirit not leading the qi". It has obvious curative effect on a series of complications including stroke. The aim of the study is to find out the effectiveness of the Xingnao Kaiqiao Acupuncture Method in Restoring Lower Limb Muscle Strength & Functions in individuals with Acute Stroke in Nepal and to optimize the clinical treatment of lower limb muscle strength and motor dysfunction after stroke.

METHODS

This study was a single-blinded randomized controlled trial conducted with a sample size of fifty participants to evaluate the efficacy of Xingnao Kaiqiao acupuncture (XNKQ) in post-stroke rehabilitation. The diagnostic criteria were based on established guidelines for cerebrovascular diseases in China. Inclusion criteria encompassed patients aged 18 to 80 years, admitted to Annapurna Neurological Institute & Allied Sciences within one week after stroke (both ischemic and hemorrhagic). Patients with specific conditions like tuberculosis, brain tumors, multiple organ failure, orthopedic diseases, infectious diseases, and those who received TPA administration were excluded. Additionally, pregnant individuals and patients below 18 years of age were not included. Data statistics were analyzed by SPSS 20 version. Paired t-test and difference-in-differences were was used for data analysis. The differences between the two groups before and after treatment were compared, with statistical significance set at p-value less than < 0.05.

Subjects who met the inclusion and exclusion criteria were randomly assigned to either the experimental group (XNKQ with conventional therapy) or the control group (conventional therapy only). Baseline evaluations, including neurological assessments and disability measurements, were performed using various scales such as GCS, Mini-Cog, MMT (muscle strength assessment), MTS, MRS, and FMA-LE (motor functioning assessment). The Modified Rankin scale was used to determine the degree of disability.

Group A (Intervention group)

The intervention group received Xingnao Kaiqiao acupuncture method, for 30 minutes, 6 times a week (except Saturday) for two weeks. No adjuvant therapy was used in the control group. The follow-up period was after 2 weeks. End-line assessment was conducted by Neuro Physician after the sessions were completed.

In this technique, Neiguan (PC6), Renzhong (DU26), Sanyinjiao (SP6), Jiquan (HT1), Chize (LU5), Weizhong (BL54) was used. Electrocupuncture was given in affected side of the lower limb by elecro-acupuncture machine, 1-100HZ to every ischaemic and non-operative patients and it was given after two days to those who were undergone operation procedure for hematoma evacuation. Needling manipulation method was as follows: Bilateral Neiguan (PC6) were pierced 1-1.5 inch straight, using the purging method combined with twisting and twirling, and applied for 1-3 minutes. Renzhong (DU26) was pierced using the sparrow peck piercing and purging method and the standard degree of manipulation was until the tearing of eyes or tears around the eyeball. Sanyinjiao (SP6) was pierced by inclining the needle tip towards back making 45 degree angle with the skin and the needle was inserted 1-1.5 inch using the lifting, thrusting and tonification method, the degree of the needling was fixed as until the continuous three times spasmodic jerk to the affected side lower limbs. For Jiquan (HT1), 1-2 inches below from its original area was pierced 1-1.5 inch and lifting, inserting and purging method was applied; degree of the needling was confirmed till 3 times spasmodic jerk of the affected upper limb was seen. Chize (LU5), was and pierced 0.5-0.8 inch directly using lifting, inserting and purging method; the needling sensation was transferred from the elbow to the fingers. Weizhong (BL40) was selected in the supine position, after insertion of the needle into the acupoint, the needle tip was inclined 15 degree outward and inserted the needle 1-1.5 inches, using lifting, inserting and purging methods; the degree of the needling was until 3 times spasmodic jerk of the affected lower extremity.

Group B (Control Group)

In this group patients were treated via conventionally as per the standard protocol followed by the hospital. The patients were categorized into ischemic and hemorrhagic. Surgical intervention in the form of decompressive craniotomy for ischemia and evacuation of hematoma for hemorrhagic bleed were done if the ICP of the patient was increased to prevent any further complications.Routine physiotherapy was given as per necessary to all the patients to this group similar to the interventional group. Triple H therapy was given for both category of stroke which includes a) Induced Hypertension: b) Hypervolemia and c) Hemodilution.

RESULTS

Total 75 patients were screened in this study. Among them total 50 samples were included in this study, 25 stroke patients were enrolled in Group A or experimental group (17 males and 8 females) who have received XNKQ along with all the conventional treatment from ANIAS. In Group B or control group, 25 stroke patients (20 males and 5 females) were enrolled and they received only conventional treatment from ANIAS. (Table 1)

Table 1: Classification of subjects according to the site of lesions

Experimental (25)				**Control (25)**			
Male (N= 17)		Female (N= 8)		Male (N= 20)		Female (N= 5)	
Rt. CVA (N=17)		Lt. CVA (N=8)		Rt. CVA (N=20)		Lt. CVA (N=5)	
Male (N= 8)	Female (N= 3)	Male (N= 9)	Female (N= 5)	Male (N= 6)	Female (N= 3)	Male (N= 14)	Female (N=2)

Table 2: Demographic data of subject group according to their ages

Age	**Experimental**	**Control group**
Range	(76-25)	(74-26)
Mean (SD)	55.68 (13.94)	56 (11.93)
CI	2.788	2.43
95% Confidence Level	55.68+/-5.466	56+/-4.77
Gender		
Male: Female	17:8	20:5

The mean age in experimental group was 55.68+-13.94 and ratio of male:female was 17:8 where in control group was 56±11.93 and the ratio of male:female was 20:5. (Table 2)

Table 3 shows the baseline values of MAS, MMT, FMA-LE, and MRS before and after intervention. In intervention group, post intervention score for MAS was 0.16±0.37, MMT score was 3.92±0.49, MRS score was 1.76±0.66 and FMA-LE score was 72.6±7.07. In control group, it was 1.80±1.19, 1.84±1.21, 3.76±0.72 and 59.24±9.68 for MAS, MMT, MRS and FMA-LE scores respectively and shows the better improvement in intervention group after XNKQ.

Table 3: Baseline value of outcome variables

Groups for treatment			**Mean**	**N**	**SD**	**Std. Error Mean**
Treatment Group	**MAS**	Pre	1.3600	25	.75719	.15144
		Post	.1600	25	.37417	.07483
	MMT	Pre	1.4800	25	1.00499	.20100
		Post	3.9200	25	.49329	.09866
	MRS	Pre	4.1200	25	.83267	.16653
		Post	1.7600	25	.66332	.13266
	FMA-LE	Pre	53.5200	25	14.82711	2.96542
		Post	72.6000	25	7.07107	1.41421
Control Group	**MAS**	Pre	1.6400	25	1.11355	.22271
		Post	1.8000	25	1.11803	.22361
	MMT	Pre	1.4000	25	1.11803	.22361
		Post	1.8400	25	1.21381	.24276
	MRS	Pre	4.4000	25	.57735	.11547
		Post	3.7600	25	.72342	.14468
	FMA-LE	Pre	54.2400	25	10.84082	2.16816
		Post	59.2400	25	9.67936	1.93587

Table 4: Paired samples test

Groups		**Paired Differences**					**t**	**df**	**Significance (p- value)**
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
					Lower	**Upper**			
Group A	MTS (Pre-Post)	1.20	.71	.14	.91	1.49	8.485	24	.000*
	MMT(Pre-Post)	-2.44	.82	.16	-2.78	-2.10	-14.868	24	.000*
	MRS(Pre-Post)	2.36	.76	.15	2.04	2.67	15.584	24	.000*
	FMA(Pre-Post)	-19.08	13.67	2.73	-24.72	-13.43	-6.978	24	.000*
Group B	MTS (Pre-post)	-.16	.85	.17	-.51	.19	-.941	24	.356
	MMT(Pre-Post)	-.44	.58	.12	-.68	-.20	-3.773	24	.001*
	MRS(Pre-Post)	.64	.91	.18	.26	1.014	3.527	24	.002*
	FMA(Pre-Post)	-5.00	6.38	1.26	-7.61	-2.38	-3.945	24	.001*

Table 4 shows mean difference of MTS in group A was 1.20±0.71 and there was significant difference in pre and post values within group A (p=0.001). Similarly, mean differences in MMT within group A was -2.44±0.82 which was very highly significant (p=0.001). MRS score was also very highly significant within group A with mean differences of 2.36±0.76 (p=0.001). FMA-LE was very highly significant within group A with mean difference of -19.08±13.67.

In group B, MMT, MRS and FMA-LE were found to be highly significant within group with mean differences of -0.44±0.58, 0.64±0.91, -5.00±6.38 respectively. There was no any significant change in MTS within group B (p=0.356).

Similarly, To evaluate difference between two groups, independent t-test was used. Table 5 shows mean differences in MRS -2.00 which was very highly significant between group A and group B (p=0.001). MTS was also found to be very highly significant between groups (p=0.001) along with MMT and FMA-LE scores.

Table 5: Paired samples test

Variables	t-test						
	Mean Difference	Std. Error Difference	df	t	Significance	95% Confidence Interval of the Difference (p-value)	
						Lower	Upper
MRS	-2.00	0.20	47.64	-10.19	0.00*	-2.39	-1.61
MTS	-1.64	0.24	29.31	-6.96	0.00*	-2.12	-1.16
MMT	2.08	0.26	31.72	7.94	0.00*	1.55	2.61
FMA-LE	13.36	2.40	43.94	5.57	0.00*	8.53	18.19

Similarly, To evaluate difference between two groups, independent t-test was used. Table 5 shows mean differences in MRS -2.00 which was very highly significant between group A and group B (p=0.001). MTS was also found to be very highly significant between groups (p=0.001) along with MMT and FMA-LE scores.

Table 6: Difference in differences

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Significance (p-value)
	B	Std. Error	Beta		
MTS	-.674	.149	-.484	-4.5	.000*
MMT	.652	.210	.359	.31	0.03*
MRS	-.793	.182	-.488	-4.7	.000*

The above table shows analysis of difference in difference for MMT, MTS, MRS, FMA-LE in treatment group computed between before and after (2 weeks) intervention.

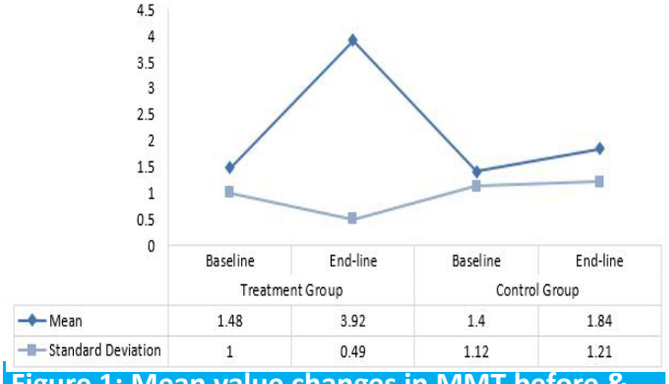


Figure 1: Mean value changes in MMT before & after treatment

Figure 1 shows mean±SD obtained for MMT pre-intervention is 1.48±1.005 and post intervention is 3.92±0.49 with p-value of 0.03 which shows that there is significant improvement in motor power after intervention.

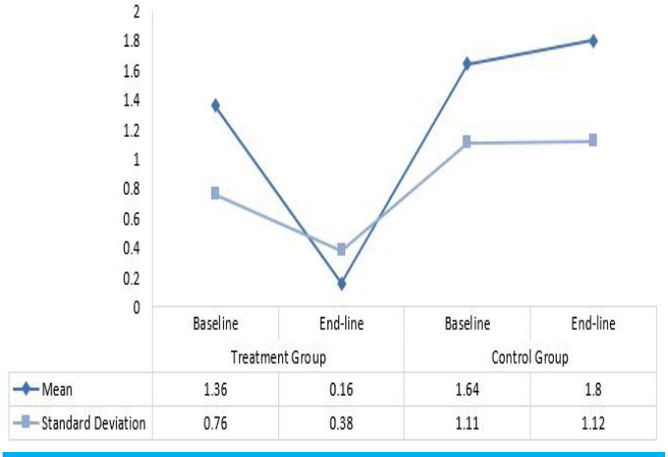
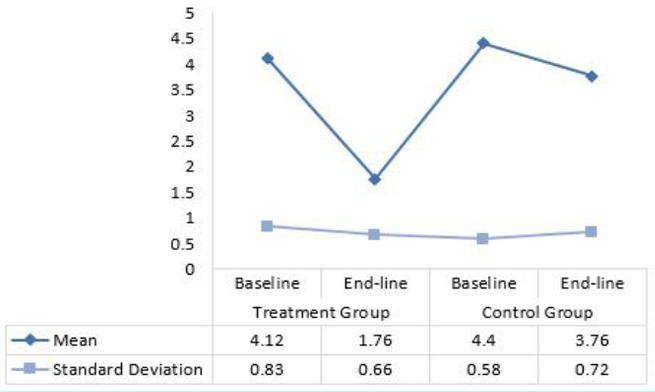


Figure 2: Mean changes in MTS before and after treatment

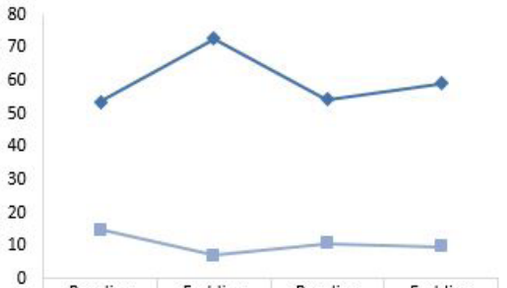
Figure 2 show the mean ± SD for MTS pre-intervention is 0.77 ± 0.858 and post-intervention of 0.75 ± 0.851 with p-value of 0.00 which shows that there is significant improvement in spasticity after intervention.



	Baseline	End-line	Baseline	End-line
	Treatment Group		Control Group	
Mean	4.12	1.76	4.4	3.76
Standard Deviation	0.83	0.66	0.58	0.72

Figure 3: Mean value changes in MRS before and after treatment

Figure 3 show mean ± SD for MRS pre-intervention is 4.12 ± 0.83 and post-intervention of 1.76 ± 0.557 with p-value of 0.00 which shows that there is significant improvement in disability after intervention.



	Baseline	End-line	Baseline	End-line
	Treatment Group		Control Group	
Mean	53.52	72.6	54.24	59.24
Standard Deviation	14.83	7.07	10.84	9.68

Figure 4: Mean value changes in FMA-LE before & after treatment

Figure 4 show mean ± SD for FMA-LE pre-intervention is 53.92 ± 14.835 and post intervention of 72.60 ± 7.071 with p-value of 0.021 which shows that there is significant improvement in functional ability after intervention.

DISCUSSION

In our study, mean age of intervention group was 55.68±14.23 and control group was 56.32±12.03 and overall mean age was 56.00±13.04. This finding is similar to that of other study done by Thapa et. al. 16% out of total subjects had early onset stroke which is a noble finding in our study. Maximum number of days for hospital stay was 15 days whereas minimum day of stay was 10. Mean hospital stay was 13.64±0.76 when combined and it was 13.33±0.83 in ischemic stroke whereas 13.39±1.11 in hemorrhagic type. This result is slightly different from previous study where hemorrhagic stroke has higher number of days in terms of hospital stay.[8-9] We also found that all the subjects demonstrated some positive effect in improving muscle strength, reducing muscle spasticity, decreasing disability and improving functional activity of the affected lower limb muscles but the interventional group had better improvement compare to control group. In the interventional group, muscle strength was significantly increased in endline assessment mean score of 3.92±0.49 from baseline assessment score of 1.48±1.004 with $p<0.05$, which means statistically significant. Similarly, functional activity of the affected lower limb significantly increased in endline assessment score of 72.60±7.071 from baseline assessment score of 53.92±14.82 with $p<0.05$, which means statistically significant. Similarly, spasticity in intervention group at the end of treatment session is 0.16±0.37 which improved from baseline score of 1.36±0.76. Overall disability decreased from 4.12±0.83 to 1.76±0.66. These score were having $p<0.05$ which is statistically significant. These findings were similar to the study done by Zhi-xin Yang and Jia-hong Xie et al 2015 which showed XNKQ needling method had a better effect than control treatment in reducing disability rate.[11]

Baseline FMA-LE score was 53.53±14.82 and 54.24±10.84 that improved to 72.60±7.07 and 59.24±9.68 in intervention group and control group respectively. This improvement were significant within their group but better improvement was seen in acupuncture group (CI 1.55-2.56) when compared to control group. FMA-LE consists of motor component, sensory component, co-ordination, range of motion and pain as its composition. There was overall improvement in all aspects of FMA-LE. Baseline MTS score was 1.36±0.75 that improved to 0.16±0.37 in intervention group whereas in control group increased from 1.64±1.11 to 1.80±1.12. Post stoke hypertonia is one of the factor that can be used as predictor of motor control and recovery following stroke. Post stroke hypertonia is suggestive of poor motor control among stroke survivors.[10]

Mean manual muscle testing in intervention group improved to 3.92±0.49 from 1.48±1.00 whereas in control group it improved to 1.84±1.21 from baseline of 1.40±1.11. Similarly, Modified Rankin Scale was used to quantify disability among participants which improved from 4.12±0.83 to 1.76±0.66 in intervention group whereas in control group it improved to 3.76±0.72 from 4.40±0.57. Ping Wu and Yu-mei Zhou et al 2018 study also showed that acupuncture can evoke pronounced structural reorganization in the frontal areas and the network of DMN areas, which may be the potential therapy target and the potential mechanism

of acupuncture for motor and cognition recovery. Han Lin, Gao Yang et al. 2018 had studied the mechanism of Xingnao Kaiqiao and found that "XNKQ" acupuncture has brain protective effect on rats with focal cerebral ischemia reperfusion injury by regulating the opening of KATP channels and decreasing the apoptosis of neurons.[12] Thus we can say that improvement in FMA-LE, MMT and MRS is mainly related to triggering the reflex activity of the brain, increase blood flow in the brain, neuronal regeneration, brain cell proliferation, improvement of neural plasticity, analgesia, structural reorganization in the frontal areas and the network of DMN areas and reducing hippocampal apoptosis.

CONCLUSION

Acupuncture method XNKQ has a significant effect on the recovery of lower limb muscle strength in patients with acute stroke. Therefore, in the scope of low-and middle-income countries like Nepal, using this acupuncture method to treat stroke patients with hemiplegia in an economical, effective and feasible way to restore the motor function of the limbs, increase muscle tension, decrease spasticity, so as to improve the quality of life of stroke patients with hemiplegia, reduce the social burden caused by disability and maximize social return.

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