

Effects of Action observation training on Motor function in Stroke Patients : A Meta-Analysis

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1 Introduction

Action observation is a method of training by observing activity performed by others, or movement or activity that appears in an image, and repeatedly imitating the observed activity or movement (Johansson, 2011). A recent study also found that action observation training increased gait stability and significant improvements in walking speed, cadence and time up and go (TUG), indicating enhanced lower limb function (Lee, 2013).

In a study involving stroke patients, experimental group was shown a video of normal movement of arms while control group was shown immovable objects or letters. The experimental group had their upper extremity function significantly enhanced compared to the control group (Ertelt, 2007).

Despite such accumulating evidence on the effect of action observation training among stroke patients in domestic and foreign studies, there are few comprehensive and systematic study on the effect of action observation training, and the results of various studies need to be combined to organize them systematically. As a very effective way of incorporating evidences, meta-analysis has been used for summarizing and analyzing studies accumulated for years and is a quantitative analysis method for objective evaluation and synthesis of studies (Oh, 2002).

We conducted a meta-analysis to combine studies on motor function improvement by action observation training among stroke patients, for the purpose of presenting the potential clinical application and effectiveness of action observation training.

2 Results

1. Action observation training on motor function

The meta-analysis on the effectiveness of action observation training on motor function among stroke patients showed effect sizes ranging between -1.05 and 3.96 . Overall effect size was 1.016 (95% confidence interval [CI], $0.51-1.52$; $P=0.000$), which can be interpreted as a 'large effect size' (Cohen, 1988) ($P<0.05$).

study	Experimental group			Control group			Total	Weight	Std. Mean Difference IV, Random, 95% CI	Std. Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total				
조진우, 박요준, 방주희, 손보영, 이복걸, 2011	16	9.40	7	1.1	9.45	6	7.10%	1.12[-0.05, 2.29]		
박진영, 유준우, 2012	3.15	1.48	7	1	1.99	7	7.70%	0.00[-1.05, 1.05]		
노원진, (2011)	4.55	6.15	10	0.72	12.36	9	6.08%	1.12[0.15, 2.09]		
원진영, 안광호, 이희진, (2012)	12.34	12.64	12	4.97	12.32	12	8.73%	0.00[0.05, 1.74]		
김기진, (2012)	4.74	14.07	12	5.17	15.40	12	8.92%	0.03[-0.77, 0.83]		
김태희, (2013)	4.57	2.58	15	2.47	0.68	15	9.65%	2.51[1.53, 3.50]		
방태희, 강태우, 조원희, 2012	$s=2.207$		6	$s=2.207$		6	6.89%	2.74[1.52, 3.96]		
김진섭, (2012)	11.22	3.31	10	3.71	5.72	10	6.99%	0.98[-0.22, 2.18]		
Ertelt, et al., 2007	3.866	6.05	8	0.3	19.29	8	7.60%	1.22[0.15, 2.29]		
Cowdes et al., 2012	$p=0.077$		9	$p=0.006$		13	6.20%	1.27[0.34, 2.20]		
Franceschini, 2012	11.5	15.91	42	6.2	15.60	39	10.49%	0.93[0.47, 1.39]		
Ertelt, Hompeyann, Ostmann, Ziesler, Hinkofski, 2012			125			125	11.47%	0.62[-0.22, 0.28]		
Total(95% CI)			241			242	100%	1.016[0.51, 1.52]		

Heterogeneity: $\tau^2=0.58$, $I^2=59.217$, $dF=11$ ($P=0.000$); $I^2=81.424$
Test for overall effect: $Z=3.935$ ($P<0.000$)
그림 2. 동작관찰 훈련이 운동기능에 미치는 영향 메타분석 결과 숲그림

2. Action observation training on upper limb function

The meta-analysis on the effectiveness of action observation training on upper limb function showed effect sizes ranging between -1.05 and 2.29 . Overall effect size was 0.72 (95% CI, 0.20 - 1.25 ; $P=0.006$), which can be interpreted as a ‘medium effect size’ (Cohen, 1988) ($P<0.05$).

study	Experimental group			Control group			Total	Weight	Std. Mean Difference IV, Random, 95% CI	Std. Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total				
조진우, 박요준, 방주희, 손보영, 이복걸, 2011	16	9.40	7	1.1	9.45	6	10.68%	1.12[-0.05, 2.29]		
박진영, 유준우, 2012	3.15	1.48	7	1	1.99	7	11.99%	0.00[-1.05, 1.05]		
방태희, 강태우, 조원희, 2012	$s=2.207$		6	$s=2.207$		6	10.44%	0.98[-0.22, 2.18]		
Ertelt, et al., 2007	3.866	6.05	8	0.3	19.29	8	11.78%	1.22[0.15, 2.29]		
Cowdes, Clark, Nares, Eggefer, Ziesler, Hompeyann, 2012	$p=0.077$		9	$p=0.006$		13	13.36%	1.20[-0.34, 2.20]		
Franceschini, 2012	11.5	15.91	42	6.2	15.60	39	19.60%	0.93[0.47, 1.39]		
Ertelt, Hompeyann, Ostmann, Ziesler, Hinkofski, 2012			125			125	22.06%	0.62[-0.22, 0.28]		
Total(95% CI)			204			204	100%	0.72[0.20, 1.25]		

Heterogeneity: $\tau^2=0.31$, $I^2=22.305$, $dF=6$ ($P=0.001$); $I^2=73.100$
Test for overall effect: $Z=2.722$ ($P=0.006$)
그림 3. 동작관찰 훈련이 상지기능에 미치는 영향 메타분석 결과 숲그림

3. Action observation training on lower limb function

The meta-analysis on the effectiveness of action observation training on lower limb function showed effect sizes ranging between -0.77 and 3.96 . Overall effect size was 1.43 (95% CI, 0.42 - 2.44 ; $P=0.005$), which can be interpreted as a ‘large effect size’ (Cohen, 1988) ($P<0.05$).

3 Discussion

In our results, the overall effect size of action observation training on motor function improvement was 1.016 ($P=0.000$), which was statistically significant and indicated a ‘large effect size’. The effect size on the upper limb function improvement was 0.72 ($P=0.006$), which was statistically significant and indicated a ‘medium effect size’. The effect size on lower limb function improvement was 1.43 ($P=0.005$), which was statistically significant and indicated a ‘large effect size’.

4 Conclusion

Action observation training yielded a ‘large effect size’ for overall motor function improvement, ‘moderate effect size’ for upper limb function improvement, and ‘large effect size’ for lower limb function improvement. These results indicate that action observation training was more effective for improving upper limb function than lower limb function. Based on the above results, we suggest action observation training as a strategy of rehabilitation intervention for motor function improvement in stroke patients

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