Case Study

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The effects of extracorporeal shock wave therapy on hemineglect following a stroke. A case report study

Abstract

Extracorporeal shock wave therapy (ESWT) is a non-invasive repetitive peripheral mechanical stimulation and might promote neuroplasticity in hemineglect syndrome. Two out of 15 patients with hemi spatial neglect following chronic stroke were completed the inclusion criterions and underwent one session of sham (placebo) and then one session of real ESWT. Both of the cases responded successfully to the ESWT by diminishing the neglect symptoms in comparison to their baseline evaluation, which maintained during one week of follow up evaluation session, but we did not observe changes in hemineglect syndrome in sham group. Our data showed that ESWT could be considered a promising tool in the treatment of neglect syndrome, however further studies are needed to confirm the effectiveness of ESWT.

Keywords: hemineglect, stroke, extracorporeal shock wave therapy, rehabilitation

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Abbreviations: ESWT, extracorporeal shock wave therapy; MAS, modified ashworth scale

Introduction

Neglect syndrome is a compound of neurological symptoms provoking the unawareness of patients to the external stimulation and it is usually due to a lesion of the non-dominant/contralateral cerebral hemisphere. Hemi spatial neglect usually results from a brain unilateral injury or stroke, which usually causes visuospatial neglect on the left-hand side of space. Hemineglect can affect visual perception, which causes ignorance of contralateral side of their body/visual field. Estimation of the incidence of hemi spatial neglect after stroke differs between 20% to 82% depending on patients sample and post-stroke onset time. Various treatments of neglect syndrome have been described (pharmacological and behavioral therapies along with brain stimulation); however, there is still no clear unity on which treatment is the most effective.[1]

Motor stimulation is thought examined to strengthen synapses in the ventral horn leading to plastic change in the spinal cord.[2] While the changes occur locally in the muscle and spinal cord, recent study has also demonstrated that it increases excitability of the contralateral motor cortex in healthy subjects.[3]

Extracorporeal shock wave therapy (ESWT) is a non-invasive repetitive peripheral mechanical stimulation, which is based on the delivery of electro-hydraulic shockwaves in low intensity and high amplitude.[4] ESWT has been used for a musculoskeletal disorder such as frozen shoulder, tennis's elbow lesions.[5] Indeed, given the possible plastic effects of a repetitive peripheral stimulation in neglect patients, we aimed to study the efficacy of ESWT on neglect syndrome symptoms after a stroke.

In this report, we reported two cases who suffered from neglect syndrome following a stroke, who responded successfully to ESWT. Both of our cases from 15 patients were completed the inclusion criteria's (Figure 1) which were

1) hemineglect syndrome due to the stroke
2) age between 18-65 years old
3) who did not present cognitive alteration (Mini mental state examination score >=24)
4) to give consent form of Institute Guttmann. Exclusion criterions were anticoagulant medications, local ulcers applied area of stimulation and the psychophysical agitation.

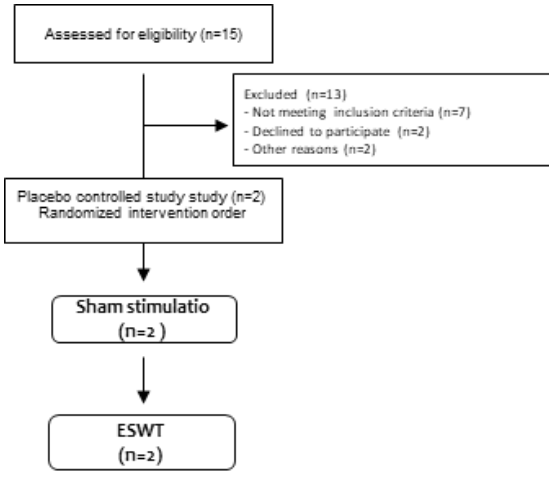

Figure 1 Flow diagram.

Both of the patients who completed inclusion criteria's received one session of sham and then real ESWT at least 1 week of break between. The evaluation of patients was done just before therapy, after one session and in 1 week of follow-up. We reported briefly the features of our patients in the study. A detailed overview of the methodology and the clinical assessment is shown in Figure 2.

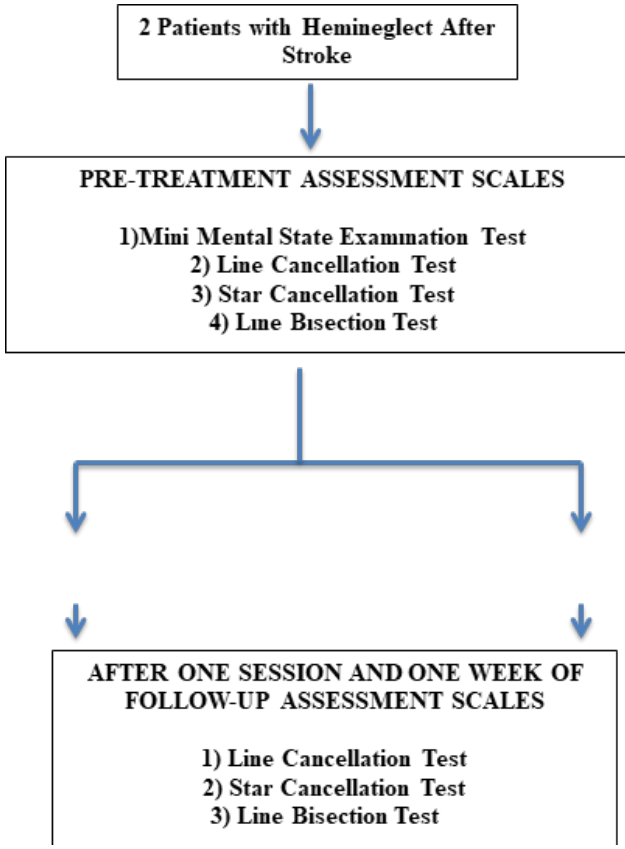

Figure 2 The methodology and the clinical assessment done in this study.

Intervention

For both sham and shock wave stimulation sessions, we applied the ESWT device (Duolith SD1, Storz Medical, Tägerwilen, Switzerland). The real ESWT (ESWT) was delivered with an average of 1500 shocks (with the focal probe) and low energy flux density of 1Bar in muscles of Biceps Brachii, triceps, extensor and flexors of the wrist except for APB where we applied 500 pulses. The intensity of the waves was increased progressively during the therapy according to patients' tolerance up to 1.4Bar. The pulses were delivered with 10 Hz frequency. During sham stimulation (sham-ESWT), we applied the device without any active stimulation.

Patients were sitting relaxed and the forearm was placed on the table with the palm facing upwards. The ESWT device probe was oriented perpendicular to the target area of each muscle. During the pre and post-stimulation sessions, we assessed the muscle strength and spasticity at the elbow using the Modified Ashworth Scale (MAS).

For clinical test sessions, we used neuropsychological evaluations to assess the neglect syndrome severity (Figure 2). To test our patients neglect syndrome, we applied

a) Albert Line Cancellation Test

b) Star Cancellation Test

c) Line Bisection Test along with Mini Mental State Examination.[6-9]

Clinical series

Case 1

The patient was a 55-year-old woman suffered from a stroke 5 months prior to our first clinical evaluation. She showed left-side neglect and spastic hemiplegia (muscle strength:0 in all muscles from the left upper limb and MAS: 3).

The presence of neglect was evaluated by using structured neuropsychological tests for specific spatial domains.

Table 1 shows patients' clinical features and pre and post-treatment neuropsychological assessment.

After ESWT, she presented an improvement in the hemineglect syndrome (Table 1). The clinical improvement was still present at the follow-up session. In addition to the improvement that we observed in neglect, spasticity was also reduced (MAS: 2) without any changes in the muscle strength.

After the sham-ESWT application, there were no changes in the neglect syndrome, neither in muscle strength nor in spasticity.

Case 2

The patient was a 56-year-old man with left side hemiplegia following stroke occurred 6 months before the clinical assessment. He presented severe spasticity (MAS: 4). The neuropsychological evaluation revealed a left- side hemineglect (Table 1).

After ESWT, a marked improvement was observed in hemineglect syndrome (Table 1**)**. Also, mild finger flexion was appeared after the ESWT application (muscular strength in the finger flexors:1, which was 0 before ESWT) and spasticity reduced to 2.5 according to MAS.

After the sham-ESWT, there were no changes in the neglect syndrome symptoms, neither in muscle strength, nor the spasticity level was applied.

Table 1 The Data of Neuropsychological Evaluation Test Applied Before, After Placebo or Extracorporeal Shockwave Therapy and During 1 Week of Follow-up

Placebo Session										
	MMST*	**Line Cancellation (total:40)**			**Star Cancellation(total:28)**			**Line Bisection (total:20)**		
Age (years)	**pre**	**pre**	**post**	**follow-up**	**pre**	**post**	**follow-up**	**pre**	**post**	**follow-up**
55	30	18	20	19	23	16	19	4	1	2
56	30	21	25	22	12	16	8	2	4	1
mean	30	19.5	22.5	20.5	17.5	16	13.5	3	2.5	1.5
Extracorporeal shock wave therapy										
55	30	32	40	39	15	16	24	2	1	2
56	30	22	28	39	8	14	24	1	6	8
mean	30	27	34	39	11.5	15	24	1.5	3.5	5

*MMST: Mini Mental Status Examination

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Discussion

The novelty of our report consists in applying of ESWT the possibility to improve neglect syndrome following chronic stroke. We believe that our patient's showed an evident improvement in hemineglect syndrome following one session of ESWT. However, the sham ESWT (sham stimulation) did not induce any changes.

This improvement following ESWT in our cases, may be related to such an the delivery of strong sensorial stimuli, might shift the attention centre towards the contralesional side, improving the neglect in addition to ESWT could strengthen synapses in the ventral horn leading to plastic change in the spinal cord[2] and/ or plastic changes in motor and/or sensory cortex.[3] The ESWT is a non-invasive repetitive peripheral mechanical stimulation, can strengthen synapses in the ventral horn leading to plastic change in the spinal cord in the hemiparetic and hemineglect extremity.[10] While changes occur locally in the muscle and spinal cord, which in turn can increases excitability of the contralateral motor cortex in those cases.[11]

The other possible explanation might be that ESWT can enhance the sensory input to the cortex. Sensory input is required for maintaining normal cortical representations within the sensory and motor cortex, including the motor performance as well as motor skills acquisition which in turn are dependent on somatosensory input. Usually, somatosensory deficits following a brain injury, such as stroke, are associated with slower recovery of the motor function.[12] Besides the traditional pharmacological and behavioural therapies for the hemineglect syndrome, the ESWT might be an alternative therapy modulation without any obvious side effects and it might support the post-stroke process by being a fast and effective therapy way.

Conclusion

Although our data showed that ESWT could be considered a promising tool in the treatment of neglect syndrome, the repetitive application of the ESWT might promote neuroplasticity more than single application at the spinal cord and/or cortical level to remodelling of the central nervous system. Further studies are needed to confirm the effectiveness of ESWT.

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Conflicts of interest

Author declares that there is no conflict of interest.

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