There is good evidence (Level 1b), to support the recommendation that functional electrical stimulation prevents shoulder subluxation in hemiplegic stroke patients, by 0.4cm over 4 weeks.

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Clinical question: Does functional electrical stimulation prevent shoulder subluxation in hemiplegic stroke patients compared to conventional physiotherapy and occupational therapy?

Clinical bottom Line: The use of functional electrical stimulation resulted in significantly less shoulder subluxation than conventional physical and occupational therapy in hemiplegic stroke patients over a 4-week trial, when provided within 48 hours post-CVA. This effect was not maintained, however, once treatment ceased.

Citation: Linn, S.L., Granat, M.H., & Lees, K.R. (1999). Prevention of shoulder subluxation after stroke with functional electrical stimulation. *Stroke, 30*:963-968**.**

Search: Medline (9), PEDro (8), OTSeeker (4), Cochrane Library (2 systematic reviews, 3 control trials) and CINAHL (11). (MeSH terms and/or text words): [shoulder subluxation OR glenohumeral subluxation] AND [electrical stimulation OR FES]. Limited to articles from 1994, human studies only, English language only.

Summary of study: Single-blinded, prospective, randomised control trial without intention-to-treat.

Population: 40 subjects were recruited from the Acute Stroke Unit with an age range of 45 to 84 years. The mean age for treatment group was 71, and mean age for control group was 73 years. 18 men and 9 women were recruited; 9 with a right sided and 31 with a left sided hemiparaesis. Recruitment criteria included: 1) no previous pathology to the shoulder, 2) the patient's CVA must have resulted in significant motor deficit in the upper limb with a grade of <2 on the Manual Muscle Test, 3) adequate communication ability to be able to cope with a verbal pain rating score, 4) no cardiac pacemaker or metal in situ**,** 5) no women of childbearing age (due to x-ray), 6) recruitment and initial measurements all within 48 hours of admission to Acute Stroke Unit. Randomisation occurred prior to initial assessments. All 40 subjects who began the experiment, finished it. Two subjects were unable to travel for final x-rays, all other measurements were conducted.

Interventions

Control group: (N=20) The control group received 4 weeks of conventional physiotherapy and occupational therapy (not specified what this entailed exactly). This was continued for 8 weeks after the treatment period (follow-up period).

Treatment group: (N=20). Subjects received a program of electrical stimulation over a 4-week period in addition to conventional physiotherapy and occupational therapy. It is not specified what this "conventional therapy was".
Electrical stimulation was given 4 times a day with a minimum of 2 hours between sessions and the length of each session increasing gradually from 30minutes in week 1, 45 minutes in weeks 2 and 3, and 60 minutes in week 4. Two electrodes were positioned on the supraspinatus fossa and the posterior aspect of the upper arm to stimulate the supraspinatus and posterior deltoid muscles. This position was checked in a pilot study prior to this project to ensure that the movement obtained produced good correction of subluxation. The stimulation consisted of asymmetrical biphasic pulses with a pulse width of 300us applied at a frequency of 30Hz. The cycle was 15 seconds on, which incorporated a ramp up time of 3 seconds and a ramp down time of 3 seconds and 15 seconds off.
This 4-week treatment period was followed by 8 weeks of physiotherapy and occupational therapy (follow-up period).

Comparisons and Outcome Measures: Comparisons were made at baseline, at 4 weeks, and at 12weeks. The comparison measurements included shoulder subluxation measurement from x-ray; pain by pain –free lateral range of motion; motor function assessed by upper arm section of the Motor Assessment Scale; upper arm girth measured by tape measure.
This appraisal looks specifically at the measurements of shoulder subluxation, which was measured by x-ray. This is due to the nature of the clinical question, which asks if FES prevents shoulder subluxation, which concerns the measure of subluxation at the shoulder. Two methods were employed to evaluate the x-rays. The first was categorisation of subluxation from 1 to 4, as described by Van Langenberghe and Hogan (1988). The second method involved using a line bisecting the glenoid fossa, then measuring the distance from the line to the most superior aspect of the head of the humerous.

Study flow: There were 2 drop outs from this study. 40 patients were recruited and 40 were measured at the final measurement phase, however two patients were not measured at the final x-ray due to inability to travel to the radiography centre. This constitutes loss to follow-up, or drop-out. All other final measurements were taken.

Appraisal

Results:

Outcome	Time to outcome	Control Group Mean Score	Treatment Group Mean Score	Mean difference between groups	P value
Categorisation of subluxation from1 –4	4 weeks	0.8	0.3	0.5	0.067
	8 week follow-up	0.63	0.63	0	0.019
	Total period	0.63	0.63	0	0.955
Humeral displacement measure – mean change	4 weeks	0.63cm	0.22cm	0.41cm	0.06
	8 week follow-up	-0.05cm	0.3cm	0.25cm	0.22
	Total period	0.62cm	0.52cm	0.1cm	0.748

The author reports that the mean difference of 0.5points (on 4pt scale) between groups for the 4-week treatment period are in favour of a the treatment group when using electrical stimulation.
These results also show a significant difference in the mean change of subluxation between groups in the 8-week follow-up period, once treatment stopped, in favour of the control group.
There is no significant difference between groups when measures are calculated for the entire study period. The entire study period constitutes of 12 weeks - 4 weeks treatment phase plus 8 weeks to follow-up period.

Validity and Applicability:

Study reported was a Randomised Control Trial, scaled at Level 1b (according to Centre for EBM, 1999, NHMRC). PEDro score for this paper was 7/10 [random allocation: yes; blind assessors: yes; blind subjects: no; blind therapists: not mentioned; adequate follow-up: yes; group comparisons: yes; eligibility criteria: yes].

Main biases include: possible therapist intervention biases. It is not mentioned whether therapists were blinded in this study, or if different therapists were used for physiotherapy and occupational therapy at different sessions. Different therapists could provide different forms of therapy and have different motivational techniques which could all impact on the outcome of this study when compared to electrical stimulation and in the follow up period.
Intervention bias (co-intervention with conventional therapy), is also present, with the conventional therapy running concurrently with the treatment group. Electrical stimulation was used in conjunction with conventional therapy, so for the authors to have still found a statistically significant difference, then the effect size of the experimental treatment is reasonable.

Outcome measures used were from a published paper (Van Langenberghe, H.V.K., & Hogan, B.M., 1988), and standard line measurement using a tape measure. Two subjects did not have final x-rays done so measures for final subluxation on these subjects could not be done. This is not mentioned in the study as having any effect, however they could have effected final mean averages.

Kill or update by: 25th April, 2005.