AOTA Critically Appraised Papers Series

Evidence Exchange

*A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project

CRITICALLY APPRAISED PAPER (CAP)

FOCUSED QUESTION

What is the effective clinical application of Functional Electrical Stimulation (FES) and task-oriented bilateral movement training for treatment of hemiparesis for adults post-stroke?

Chan, M., Tong, R., & Chung, K. (2009). Bilateral upper limb training with functional electrical stimulation in patients with chronic stroke. *Neurorehabilitation and Neural Repair, 23*(4), 357–365. http://dx.doi.org/10.1177/1545968308326428

CLINICAL BOTTOM LINE:

This was a double-blinded randomized control trial study that examined the effectiveness of the combined treatments of FES and bilateral upper-extremity, task-oriented training for adults 6 weeks post-stroke. The results indicated that the FES group, which received muscle stimulation during the performance of functional activities, had statistically significant improvements in upper-extremity functional mobility of the affected limb compared to the control group. The findings of this study show a positive consideration for a new treatment method in using FES in an effort to treat hemiparesis for adults post-stroke. Individuals with hemiparesis due to stroke could increase functional ability in their affected arm by incorporating the affected arm in functional activities rather than compensating for the deficits and relying too heavily on the non-affected limb.

Limitations of this study included a small sample size and lack of a follow-up with the participants to determine long-term effects. Further research is encouraged in this area, including larger sample sizes and using different modality treatment combinations with task-oriented training.

RESEARCH OBJECTIVE(S)

List study objectives.

- This study aimed to investigate the effectiveness of combining FES treatment with task-oriented bilateral movement training for adults with chronic stroke.
- The focus of the study was to determine an effective treatment to restore upper-extremity function in those affected by stroke.

- The research objectives of this study applied to the focused question in that FES is being used as a form of treatment for individuals recovering from a stroke.

DESIGN TYPE AND LEVEL OF EVIDENCE:

This study was a double-blinded randomized control trial design and is therefore at a Level I of evidence.

Limitations (appropriateness of study design):

Was the study design type appropriate for the knowledge level about this topic? *Circle yes or no, and if no, explain.*

YES/NO	

SAMPLE SELECTION

How were subjects selected to participate? Please describe.

Subjects were selected from an occupational therapy outpatient department of a rehabilitation hospital, and each had experienced their first stroke. If the participants qualified for the study in regard to the inclusion and exclusion criteria, they gave informed consent and were then randomly assigned to either the FES group or the control group.

Inclusion Criteria

Participants could not have a skin allergy to electric stimulation or electrodes. Participants needed to receive a score of 0 in the finger mass extension sub-item of the Fugl–Meyer Assessment. Participants needed to be able to follow simple instructions. This needed to be their first stroke, and the time period was 6 weeks after onset of their stroke. Participants were also evaluated on the Glasgow Coma Scale and needed to score a 15/15 to participate in this study.

Exclusion Criteria

Participants were excluded if they had inadequate communication due to severe dysphasia, if they had any other conditions that could potentially affect the results of the study, or if they had a history of other neurological or psychiatric disorders.

SAMPLE CHARACTERISTICS

N = 20

% Dropouts	0		
#/ (%) Male	11 (55%)	#/ (%) Female	9 (45%)
Ethnicity	NR		
Disease/disability diagnosis	Stroke		

Check appropriate group:

<20/study group ✓	20–50/study group	51–100/study group	101–149/study group	150–200/study group

INTERVENTION(S) AND CONTROL GROUPS

Add groups if necessary

Group 1

Brief Description	10 participants were randomly assigned into the FES group. This group received the FES treatment during the bilateral task-oriented training activities.
Setting	Participants attended treatment sessions at the institution. Participants were seated at a table for the duration of the treatment session.
Who Delivered?	Participants self-delivered the FES treatment via a motion detection system placed on the accelerometer. The participant used finger extension to trigger the stimulation. Assessments and further treatment were provided by a blinded occupational therapist.
Frequency?	Participants attended 15 sessions that were 1.5 hours in duration.
Duration?	NR

Group 2

Brief Description	10 participants were randomly assigned into the control group. This group received a placebo FES treatment that provided electrical stimulation but not enough stimulation to produce muscle movement. This group also participated in task-oriented bilateral training.
Setting	The participants in this group attended intervention sessions at the institution and were seated at a table for the duration of the treatment.
Who Delivered?	The participants self-delivered the placebo FES treatment with an accelerometer on their finger that triggers stimulation when finger extension is produced. An occupational therapy practitioner unaware of the participant's group assignment completed assessments and treatment.
Frequency?	Participants attended 15 sessions lasting 1.5 hours.
Duration?	NR

Group 3

Brief Description	N/A
Setting	N/A
Who Delivered?	N/A
Frequency?	N/A
Duration?	N/A

Intervention Biases: *Circle yes or no and explain, if needed.*

Contamination

YES/NO	

Co-intervention

YES (NO)

Timing

YES (NO)

Site

YES (NO)

Use of different therapists to provide intervention

NR The study did not report details on the occupational therapists who provided the treatment in regard to whether or not the same therapist provided the outcome measures and then provided intervention for both of the groups.

MEASURES AND OUTCOMES

Complete for each relevant measure when answering the evidence-based question:

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article--yes/no/NR [not reported]), and how frequently the measure was used.

Functional Test for the Hemiplegic upper Extremity (FTHUE): Used to evaluate ability to use upper extremity during ADLs. Reliability and validity were not reported. This outcome measure was used as a pre- and posttest.
Fugl–Meyer Assessment (FMA): This assessment measures the motor function of the upper extremity affected by hemiparesis. FMA has a high interrater and test–retest reliability for this study's population. This outcome measure was used at baseline and after 15 sessions.
Measurement of forward-reaching distance: Participants were seated in a chair and asked to reach forward as fast as they could to reach the target placed in front of them. This measurement was used as a baseline. Reliability and validity were not reported. This outcome measure was used at baseline and after 15 sessions.
Grip power: This outcome measure was done by using the Jamar hand dynamometer to assess the grip strength of the affected hand. Reliability and validity were not reported. Grip strength was measured at baseline and at the end of the study.
Functional Independence measure (The FIM): Used to determine the participants' level of independence in ADLs. Validity and reliability were not reported. The FIM was used as a pre- and posttest.
Modified Ashworth Scale: This outcome measure is a reliable assessment for measuring the spasticity post stroke and was used in this study to measure muscle tone. Validity was not reported for this measure. This outcome measure was used as a pre- and posttest.

Measurement Biases

Were the evaluators blind to treatment status? *Circle yes or no, and if no, explain.*

YES/NO	The occupational therapy practitioners provided intervention were blinded to the participants who had received the placebo vs. actual FES.

Recall or memory bias. *Circle yes or no, and if **yes,** explain.*

YES/NO	

Others (list and explain):

N/A

RESULTS

List results of outcomes relevant to answering the focused question

Include statistical significance where appropriate ($p < 0.05$)
Include effect size if reported

- Effect size was calculated only for the considered 3 most significant outcome measures (FMA, FTHUE, and active range of motion [AROM] of wrist extension).
- Effect size = 0.52–1.52.
- FMA and wrist extension showed a medium effect size, and the FTHUE showed a large effect size.
- FES group statistical analysis, based on $p < 0.05$, resulted in statistically significant results in all outcome measures.
- An ANCOVA was carried out in comparing the outcomes of the FES group and the control group.
- ANCOVA reported that the FMA resulted in a *p* value of 0.039, which indicated a significant difference in upper-extremity motor functioning.
- The FTHUE ANCOVA resulted in a *p* value of 0.00,1 and an AROM with wrist extension had a *p* value of 0.020, which indicated a statistical significance in functional improvement from baseline to post-treatment.
- Overall, the FES group showed a significant difference in measurement outcomes.

Was this study adequately powered (large enough to show a difference)? *Circle yes or no, and if no, explain.*

YES/NO	An ANCOVA statistical test was carried out to increase the power of the study. However, the sample size was small.

Were appropriate analytic methods used? *Circle yes or no, and if no, explain.*

YES/NO	

Were statistics appropriately reported (in written or table format)? *Circle yes or no, and if no, explain.*

YES/NO	

CONCLUSIONS

State the authors' conclusions that are applicable to answering the evidence-based question.

The results of this study indicated that bilateral upper-extremity, task-oriented training combined with FES treatment increased the mobility and functional use of the affected limb due to stroke. This was based on the outcome areas of the FMA, FTHUE, forward-reaching distance, AROM of wrist extension, and grip power. Limitations of this study that were noted by the authors were small sample size, and there was no follow-up with the participants to receive data to conclude the generalizability of the treatment. Results may be considered conclusive based on large effect size and study design, although sample size was small. Further research considerations include the use of a larger sample size and utilizing different modality treatment combinations with task-oriented training.

This work is based on the evidence-based literature review completed by Kelly Erickson, PhD, OTR/L (Assistant Professor, The College of Saint Scholastica) and Kirsten Skundberg, OTS (Occupational Therapy Student, The College of Saint Scholastica).