Electrical Stimulation Results Table

Author, Year, Country, Design, PEDro score, Rating	**Sample Size**	**Intervention**	**Outcomes and significance:** **(+) significant (-) not significant**
Karabay et al., 2012 Turkey RCT 7/10 High quality	**N=** 33 children with spastic diplegic CP **Age at enrollment:** 2-10 years **CP diagnosis:** 100% **CP Type:** N/A **GMFCS (Gross Motor Function Classification System) Level:** N/A	Functional Electrical Stimulation (FES) (n=17) vs. Physical Therapy and Rehabilitation (PTR) (n=16) ***Intervention details***: *FES Group:* • Received PTR in addition to electrical stimulation • Electrical stimulation was applied 5 days a week for 4 weeks to abdomen-posterior back muscles in 30 min long sessions *PTR Group:* • Received PTR program for 4 weeks Physical Therapy Rehabilitation: • Conventional methods: - Preservation of joint mobility - Muscle strengthening - Mobility activities • Neurodevelopmental Treatments (Bobath technique) - Aims to form normal motion patterns by normalizing tonus of muscles - Attempts to inhibit abnormal reflexes and facilitates automatic reactions in order to decrease deficiencies caused by spasticity and abnormal reflex patterns	**At post-treatment (4 weeks):** *Seated balance:* (+) Gross Motor Function Measurement - Sitting *Trunk asymmetry (seated)* Radiographic Measurements (+) Kyphotic Angle (+) Cobb Angle (-) Sacral Angle

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Umay et al., 2020
 	
Turkey
 	
RCT
 	
6/10
 	
High quality
	N = 102 children with CP who had oropharyngeal dysphagia symptoms
	
	Age at enrollment: 2-6 years
	
	CP diagnosis: 100%
	
	CP Type:
	
	Spastic: 96/102 (94%)
	Dyskinetic: 5/102 (5%)
	Hypotonic/ataxic: 1/102 (1%)
	
	Motor limb distribution (%):
	
	Hemiplegia: 35/102 (34%)
	Diplegia: 14/102 (14%)
	Triplegia/quadriplegia: 53/102 (52%)
	
	CP Level (GMFCS) (%):
	
	Level I: 0/102 (0%)
	Level II: 18/102 (18%)
	Level III: 21/102 (21%)
	Level IV: 38/102 (37%)
	Level V: 25/102 (24%)
		Sensory level electrical stimulation combined with conventional dysphagia rehabilitation
		(n=52)
		
		vs.
		
		Sham stimulation with conventional dysphagia rehabilitation
		(n=50)
		
		***Intervention details*:**
		
		Sensory level electrical stimulation (intermittent galvanic stimulation to bilateral masseter muscles) combined with conventional dysphagia rehabilitation:
		
		• 30 minutes/day, 5 days/week
		• 4 weeks
		• Intermittent galvanic stimulation to bilateral masseter muscles
		• Children positioned at 90° supported/unsupported seating
		• 2 pieces of 3x3cm surface electrodes were placed
		  - The ramus of the mandible
		  - Bell of the masseter muscle
		• Stimulation intensity was based on threshold sensibility
		
		Sham stimulation with conventional dysphagia rehabilitation:
		
		• Received sham stimulation (stimulator was turned off)
		• Electrodes placed in same place as intervention group
			At post-treatment (4 weeks):
			
			Dysphagia:
			
			(+) Pediatric Eating Assessment Tool-10
			
			(+) Flexible Fiberoptic Endoscopic Evaluation of Swallowing

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		Both groups: • Daily care for oral hygiene • Thermal care and tactile stimulation • Head and trunk positioning • Dietary modification • Oral motor ROM and strengthening exercises (lips, tongue, jaw, hyoid, laryngeal elevation) applied to cooperative children	
Xu et al., 2015 China RCT 8/10 High quality	**N =** 68 children with hemiplegic CP **Age at enrollment:** 2-14 years **CP diagnosis:** 100% **CP Type:** Unilateral (Hemiplegic) 100% **CP Level (GMFCS) (%):** Level I: 60/68 (88%) Level II: 8/68 (12%) **CP Level (MACS) (%):** Level I: 10/68 (15%) Level II: 49/68 (72%) Level III: 9/68 (13%)	Constraint-induced movement therapy (CIMT) (n=22) vs. Constraint-induced movement therapy plus electrical stimulation (CIMT-ES) (n=23) vs. Traditional occupational therapy (OT) (n=23) **Intervention details:** • 3 certified OTs provided treatments for all children • OTs completed follow-up phone calls once every 2 weeks to monitor home based exercise programs *Traditional occupational therapy:* • 3 hours a session, 5 days/week for 2 weeks • With 1 hour home-based exercises program to be done daily • After above intervention, home-based exercise program was increased to 2 hours daily for 6 months • Parents completed activity log to monitor compliance	***CIMT-ES vs. CIMT:*** **At post-treatment (2 weeks from baseline):** *Muscle recruitment and coordination:* Surface EMG (-) Root mean square (RMS) of involved wrist extensor (-) RMS of involved wrist flexors (-) RMS of uninvolved wrist extensor (-) RMS of uninvolved wrist flexors (-) Integrated EMG (iEMG) of involved wrist extensors (-) iEMG of involved wrist flexors (-) iEMG of uninvolved wrist extensors (-) iEMG of uninvolved wrist flexors (-) Cocontraction ratio *Grip strength:* (-) Sphygmomanometry *Motor function:* (-) Upper extremity functional test (-) Global rating scale

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		• Functional unimanual and bimanual training • Advice and treatment aimed at reducing spasticity, improving hand function and ADLs • The provision of appropriate orthotics *Constraint-induced movement therapy (with orthosis of the uninvolved hand):* • 3 hours a session, 5 days/week for 2 weeks • With 1 hour home-based exercises program to be done daily • After above intervention, home-based exercise program was increased to 2 hours daily for 6 months • Parents completed activity log to monitor compliance • Personal instruction from professionals involving the specific practice of Designated target movements • Children completed therapeutic functional activities using the involved hand • The difficulty of the activity was increased by changing either temporal or spatial/accuracy tasks constraints *Constraint-induced movement therapy (detailed above) plus electrical stimulation*: • Electrical stimulation was applied 20 minutes/day, 5 days/week, for 2 weeks • Extensor carpi radialis (of involved UE) • Extensor digitorum (of involved UE) • MyoTrac Infiniti dual-channel neuromuscular electrical stimulation unit and reusable carbonized-rubber electrodes • Frequencies set at 50Hz, pulse rate 30 pulses per second with 300us of amplitude (max amplitude of 100mA). • ON time was set to 12 seconds with 1 second of rise and decay and an OFF time for 12 seconds.	**Follow-up (3 months from baseline):** *Muscle recruitment and coordination:* Surface EMG (-) RMS of involved wrist extensor (-) RMS of involved wrist flexors (-) RMS of uninvolved wrist extensor (-) RMS of uninvolved wrist flexors (+) iEMG of involved wrist extensors (-) iEMG of involved wrist flexors (-) iEMG of uninvolved wrist extensors (-) iEMG of uninvolved wrist flexors (+) Co-contraction ratio *Grip strength:* (-) Sphygmomanometry *Motor function:* (-) Upper extremity functional test (-) Global rating scale **Follow-up (6 months from baseline)** *Muscle recruitment and coordination:* Surface EMG (-) RMS of involved wrist extensor (-) RMS of involved wrist flexors (-) RMS of uninvolved wrist extensor (-) RMS of uninvolved wrist flexors (+) iEMG of involved wrist extensors (-) iEMG of involved wrist flexors (-) iEMG of uninvolved wrist extensors (-) iEMG of uninvolved wrist flexors (+) Cocontraction ratio

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		• Amplitude was increased slowly to the child's tolerance without causing discomfort, and adjusted to induce muscle contraction for all children.	*Grip strength:* (-) Sphygmomanometry *Motor function:* (-) Upper extremity functional test (-) Global rating scale ***CIMT-ES vs. OT:*** **Post treatment (2 weeks from baseline):** *Muscle recruitment and coordination:* Surface EMG (-) RMS of involved wrist extensor (-) RMS of involved wrist flexors (-) RMS of uninvolved wrist extensor (-) RMS of uninvolved wrist flexors (-) iEMG of involved wrist extensors (-) iEMG of involved wrist flexors (-) iEMG of uninvolved wrist extensors (-) iEMG of uninvolved wrist flexors (-) Cocontraction ratio *Grip strength:* (-) Sphygmomanometry *Motor function:* (-) Upper extremity functional test (-) Global rating scale

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