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Title: Acute effects of volume-oriented incentive spirometry on chest wall kinematics in patients chronic stroke

Ms. Illia 23806 Lima illialima@yahoo.com.br [1], Prof. Dr Gardênia 23807 Ferreira holanda@ufrnet.br [1], Prof. Dr Tânia 23808 Campos taniacampos@ufrnet.br [1], Mr. Rodrigo 23809 Melo rodrigomelo89@hotmail.com [1], Ms. Elis 23810 Emanuelle elis_emanuelle@yahoo.com.br [1], Mr. Rêncio 23817 Florêncio rencio.bf@hotmail.com [1] and Prof. Dr Guilherme 23819 Fregonezi fregonezi@ufrnet.br [1]. [1] Physical Therapy, Federal University of Rio Grande do Norte, Natal, RN, Brazil, 59072970 .

Body: To study the acute effects of incentive spirometry (IS) volume-oriented on chest wall kinematics in chronic stroke patients and healthy subjects. Volume of chest wall (CW), abdominal (ab), abdominal rib cage (RCab) and pulmonary rib cage (RCp) compartment were assessed in 20 chronic stroke patients (experimental group,EG) age 56±9.7 years old, FVC%:81.5±10.9 % and FEV1/FVC%:80.5 ±9.7 and 20 age-matched healthy subjects (control group,CG), age 56.5±10.3 years old, FVC%:95±6.8% (p=0.0028) and FEV1/FVC%:80.5 ±8.4 by Optoelectronic Plethysmography. Protocol comprise 3 moments: quite breathing (QB), volume-oriented IS (3 series/10 repetitions) and recovery quite breathing (rQB).The tidal volumes of chest wall in EG was lower compared to the CG, in QB (0.4vs0.61L), IS (1.8vs2.3 L) and rQB (0.4vs0.5 L) ($p<0.0001$). The tidal volume increase in chest wall 75% in EG and 73.3% CG during IS. Different pattern of breathing were found in tidal volume in EG compared to CG on ab compartment: QB(54.1%vs43.7%), IS(43.3%vs40.9%) and rQB(48.9% vs. 46.2%); RCab compartment, QB(13.8%vs16.8%), IS(19%vs20.6%) and rQB(15.2%vs17.2%) and RCp compartment, QB(30.7%vs37.9%), IS(37.7%vs39.9%) rQB(32.9%vs37.3%). Right and left hemithorax volume were different in EG, QB (ΔVt=0.06±0.04 ml vs 0.02±0.02 ml, p=0.002), IS(ΔVt=0.09 ±0.07 ml vs. 0.07±0.05 ml) and rQB(ΔVt= 0.07±0.07 vs 0.02±0.03 ml) independent of stroke side impairment. Chest wall volumes are decrease in patients with chronic stroke. IS induces improvements in volume of chest wall in both groups; however, more pronounced in chronic stroke patients determining a breathing pattern similar that was observed in healthy subjects.