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Title: Heart rate variability in obstructive sleep apnea: A non linear analysis

Ms. Renata 13705 Trimer retrimmer@hotmail.com , Ms. Fernando 13706 Sousa Melo Costa fernandocostafisio@yahoo.com.br , Dr. Renata 13707 Gonçalves Mendes mendesrg@hotmail.com , Prof. Dr Luciana 13708 Maria Malosá Sampaio luciaanamalosa@uninove.br , Dr. Antônio 13709 Delfino Oliveira Júnior adoliveirajr@yahoo.com.br , Dr. Federico 13722 Aletti federico.aletti@polimi.it , Prof. Dr Ross 13725 Arena rarena@gmail.com and Prof. Dr Audrey 13727 Borghi- Silva audrey@ufscar.br . ¹ Physiotherapy, Federal University of São Carlos, São Carlos, Sao Paulo, Brazil, 13565-905 ; ² Instituto Do Sono De São Carlos, Instituto Do Sono De São Carlos, Sao Carlos, Sao Paulo, Brazil, 13560-000 ; ³ Physiotherapy, UNINOVE, Sao Paulo, Brazil ; ⁴ Elettronica, Informazione e Bioingegneria, Politecnico Di Milano, Milano, Italy and ⁵ Physiotherapy, New Mexico University, Albuquerque, United States .

Body: Obstructive sleep apnea (OSA) is associated with an increase in arrhythmia frequency and a higher risk of sudden cardiac death. Heart rate variability (HRV) can be altered in OSA patients. However, traditional measures of HRV may uncover abnormalities in different sleep stages that are not easily detectable with traditional time and frequency domain measures. In this context, non linear HRV analysis, which provides the basic physiologic dynamics of normal sinus rhythm as a fractal-like feature, has not yet been investigated during different parts of the sleep cycle. Objectives: To assess differences in non linear HRV during sleep stage II and REM in OSA and apparently healthy controls. Methods: Twenty mild and twenty moderate OSA patients as well as eighteen age-matched controls were included in the study. A standard polysomnography followed by simultaneous electrocardiography. R-R intervals (RRi) were analyzed by Poincarre Plot and Recurrence Plot during the stage II and REM sleep each containing 5-minute samples which were free of stage shifts, artifacts, arousals and apneas. Results: We observed that LMean, REC, DET and ShanEn were higher in REM stage when compared with stage II in all subjects ($p<0.05$). In addition, Moderate OSA patients presented higher values of SD2 and DET ($p<0.05$) that mild OSA and controls. Conclusion: The application of non-linear HRV measures can provide additional insights in sleep studies, particularly during event free-periods. During REM sleep, mild and moderate OSA presented altered HRV when compared with controls, especially during REM sleep, suggesting sympathetic overdrive and alterations of complexity of HR. Financial Support: FAPESP (2009/01842-0) and CAPES.