



**ACADEMIC EXAMINATIONS**  
AT THE FACULTY OF MEDICINE OF THE UNIVERSITY OF LISBON  
ADVANCED EDUCATION INSTITUTE

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**Master:** Sleep Sciences (3<sup>rd</sup> Edition)

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**Title of the Thesis:** Sleep neuro-physiological characteristics in patients with periodic limb movement disorder and restless legs syndrome: a comparative study of polysomnographic findings and spectral analysis of electroencephalogram.

**Date of Viva Voce Examination:** 16-11-2010

**Classification:** 19 marks

**Panel:**

**President:** Professor Fernando Lopes da Silva (FMUL)

**Supervisor:** Professor Teresa Paiva (FMUL)

**Voting Member:** Professor António Martins (FMUP)



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**ABSTRACT**

**Introduction:** Typical changes in spectral EEG activity have been described in limb movement (LM) in Restless Legs Syndrome (RLS). Therefore, EEG spectral analysis can be a strong instrument to detect and characterize functional problems of sleep mechanisms.

**Objective:** The aim was to evaluate the differences of EEG spectral power associated with limb movements in RLS and PLMD patients.

**Methods:** Polysomnographic data were obtained in 19 RLS patients and in 19 PLMD patients, matched by gender and age. Polygraphic recordings were conventionally analysed and LM were detected and classified according to WASM 2007 criteria. The first ten LMs of non-REM of N2 not associated with arousals, nor with EEG artefacts, were selected. Spectral EEG analyses considered three epochs: a) 10 seconds preceding each LM; b) period coincident with the LM; c) 10 seconds following the end of each LM. These periods were compared with 10 second periods of N2 undisturbed sleep, without LM or arousals.

**Results:** There are no significant differences between RLS and PLMD patients at the PSG parameters, although some mean values differ. The PLM number and its duration characteristics did not differ significantly between RLS and PLMD patients ( $p > 0,05$ ). However, the RLS patients present a higher number of PLM, sleep latency and number of sleep changes, presenting high levels of sleep fragmentation (89,5%). The slow wave sleep is compromised in 68,4% of PLMD patients, while just 31,6% of RLS patients show this condition. At this case we have a correlation between the compromises of slow wave sleep and PLM disorder ( $p = 0,05$ ;  $\phi = 0,368$ ). There are a compromise of sleep efficiency in both sleep disorders, and all patients present pathological number of LM. EEG activation occurs at the LMs, particularly by the Delta, Theta and Alpha bands, showing a significant increase in power peaking during the LMs. This is showed by significant differences ( $p < 0,05$ ) between the power spectrum of Delta, Theta, Alpha, Beta and Gamma frequencies, obtained 10 seconds preceding the LM and the period coincident with the LM, and obtained at this period and the 10 seconds following the LM.

However, there were no significant differences at this power response between RLS and PLMD patients ( $p > 0,05$ ). Profile of averaged EEG frequency bands of spectral power of 10 seconds periods of undisturbed sleep, show an EEG activation preceding the LMs at the Beta and Sigma frequencies, showing an earlier response at the motor event. Gamma band was significantly increased after the LM. There are significant correlations between Gamma power and the number of LM, the arousals associated with the LM and with the number of sleep stage shifts ( $\rho > 0,4$ ). **Conclusion:** From these data we conclude that EEG responses to LM by significant activation of Delta, Theta and Alpha activity power. However, there are no significant differences between RLS and PLMD at this power frequency response. Besides the PSG parameters did not differ significantly between RLS and PLMD, the sample show some mean differences, indicating differences at the sleep disturbance. The power spectrum profile of the Gamma band shows an association with the post LM motor event and with arousals mechanism, indicating an event-related desynchronization of the brain.

**Keywords:** RLS; PLMD; LM; Spectral analysis; EEG.