ESCOLA SUPERIOR DE TECNOLOGIA DA SAÚDE DE LISBOA
INSTITUTO POLITÉCNICO DE LISBOA

XV Seminário Temático em Fisiologia Clínica
11 de fevereiro de 2022

Fisiologia Clínica

Sleep Profiler™:
monitorização wireless do sono

Estudantes: Joana Cangaia nº2018262
Dora Duarte nº2018283
João Mendes nº2018260
Orientadora: Professora Joana Belo

SEMINÁRIO Temático

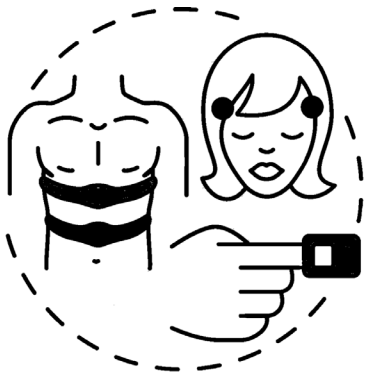
Sono

- Mecanismo fundamental para o bem-estar e funcionamento do ser humano[1];
- Alterações do sono podem comprometer a saúde e o bem-estar[1];
- Essencial um estudo aprofundado quando existe a suspeita de distúrbios do sono[1].

1. Chinoy ED, et al. Performance of seven consumer sleep-tracking devices compared with polysomnography. 2021

Estudo do sono

- **Poligrafia do Sono de nível I, II, III ou IV**
  - Nível I: mais completa, inclui EEG, EOG, EMG SM e TA, fluxo e esforço respiratório, saturação O2, ECG e posicionamento corporal, com supervisão profissional[2];
  - Nível II: idêntica à PSG Nível I, sem supervisão profissional[2];
  - Nível III: normalmente 4 canais, fluxo e esforço respiratório, ECG, saturação de O2 e ronco, habitualmente sem supervisão profissional [2];
  - Nível IV: normalmente apenas 2 canais, ECG e saturação de O2, sem supervisão profissional [2].
- **Actigrafia**
- **Avaliação da sonolência**
  - Teste de latências múltiplas
  - Pupilografia
  - Teste de manutenção da vigília
  - *The Oxford Sleep Resistance* (OSLER)
  - Teste de vigilância psicomotora



2. Rundo JV, Downey R. Polysomnography. Handb Clin Neurol. 2019

Polissonografia (Nível I)

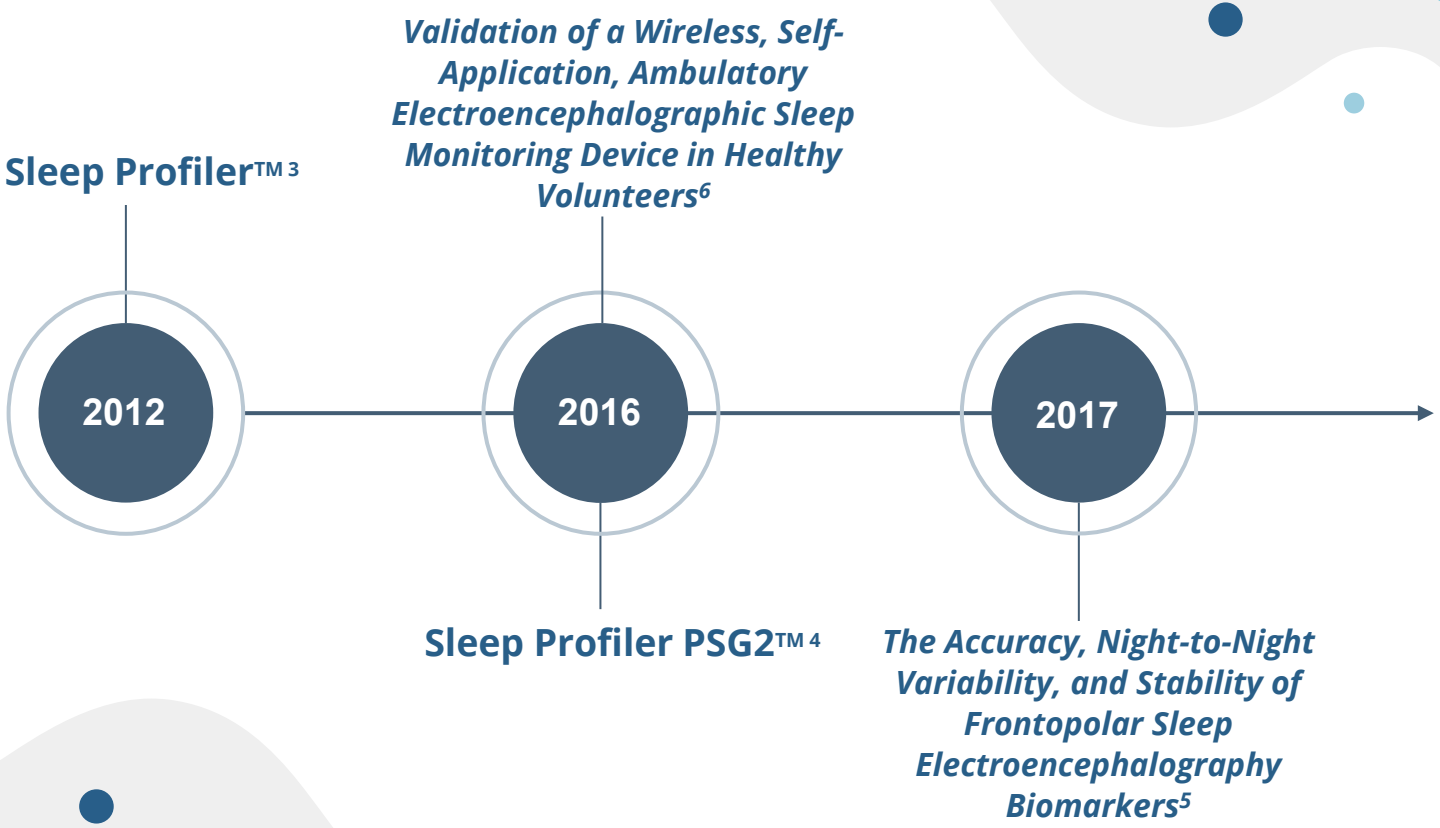
- Exame *Gold standard* no diagnóstico na maioria dos distúrbios do sono[2];
- Permite o registo, em simultâneo, de vários parâmetros fisiológicos e comportamentais durante o sono[2].

Limitações:

- Necessidade de profissionais especializados[2];
- Demorado[2];
- Incómodo[2].

2. Rundo JV, Downey R. Polysomnography. Handb Clin Neurol. 2019 Jan 1;160:381–92.

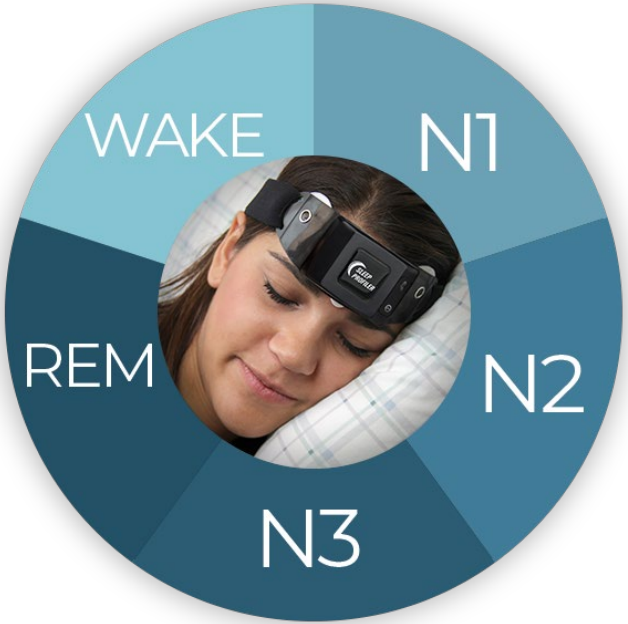
Sleep Profiler™



3. Sleep Profiler [Internet]. [cited 2022 Jan 31].
4. Sleep Profiler PSG2 [Internet]. [cited 2022 Jan 31
5. Levendowski DJ, et al. The accuracy, night-To-night variability, and stability of frontopolar sleep electroencephalography biomarkers. 2017
6. Finan PH, et al. Validation of wireless self application ambulatory EEG. J Clin Sleep Med. 2016

Sleep Profiler™

- Regista EEG, EOG, EMG, ECG, Ronco, Posição e movimento da cabeça;
- *Auto-staging* com equivalência a uma PSG;
- Até 30h de registo;
- Monitorização o estado do estudo e envia notificações.



3. Sleep Profiler [Internet]. [cited 2022 Jan 31].

Sleep Profiler PSG2™

- Regista EEG, EOG, EMG, ECG, Ronco, Posição e movimento da cabeça[3];
- **Permite ainda o registo do Fluxo de ar, Esforço respiratório e Saturação**[3];
- Deteção automática de hipopneias, apneias obstrutivas e centrais e dessaturações[3];
- Monitoriza o estado do estudo e envia alertas de forma a melhorar o sinal[3].

4. Sleep Profiler PSG2 [Internet]. [cited 2022 Jan 31].

Artigos de Validação

The Accuracy, Night-to-Night Variability, and Stability of Frontopolar Sleep Electroencephalography Biomarkers[5]

47

5

>80%

Table 4—Contingency table of agreement between majority PSG staging by human scorers versus Sleep Profiler expert edited default autostaging of pooled epochs.

	Expert edited autostaging				
Majority of scorers staged as:	**Awake (%)**	**N1 (%)**	**N2 (%)**	**N3 (%)**	**REM (%)**
Awake	86.8	32.2	3.0	0.3	1.9
N1	9.3	32.6	5.3	0.6	8.8
N2	2.7	33.3	86.0	16.2	9.3
N3	0.1	0.1	5.4	82.9	0.0
REM	1.2	1.8	0.3	0.0	80.0
No consensus	3.4	6.3	1.6	0.5	2.0
No. epochs	8,018	3,262	14,425	3,723	4,201

PSG = polysomnography.

5. Levendowski DJ, et al. The accuracy, night-To-night variability, and stability of frontopolar sleep electroencephalography biomarkers.. 2017

Artigos de Validação

Validation of a Wireless, Self-Application, Ambulatory Electroencephalographic Sleep Monitoring Device in Healthy Volunteers[6]

14

2

Table 4—Agreement analysis of PSG versus SP Manual.

Stage	Agreement	κ (95% CI)	Sensitivity % (95% CI)	Specificity % (95% CI)
Wake	0.93	0.44 (0.32, 0.56)	40.08 (36.97, 43.26)	97.68 (97.39, 97.93)
N1	0.93	0.13 (0.10, 0.17)	27.03 (22.33, 32.14)	94.79 (94.39, 95.16)
N2	0.81	0.61 (0.52, 0.70)	75.91 (74.83, 76.97)	84.63 (83.77, 85.47)
N3	0.90	0.71 (0.67, 0.74)	73.92 (72.30, 75.50)	94.74 (94.29, 95.17)
REM	0.90	0.73 (0.65, 0.80)	86.03 (84.69, 87.31)	91.41 (90.86, 91.94)

Agreement, K, sensitivity, and specificity, along with 95% confidence intervals, are presented for each stage for the comparison of average of the scored polysomnography records to the average of the primary manual score of the Sleep Profiler.

6. Finan PH, et al. Validation of wireless self application ambulatory EEG. J Clin Sleep Med [Internet]. 2016

Estudos que utilizaram o Sleep Profiler™

ALZHEIMER'S DISEASE

Reduced non–rapid eye movement sleep is associated with tau pathology in early Alzheimer's disease

Brendan P. Lucey[1,2]*, Austin McCullough[3], Eric C. Landsness[1], Cristina D. Toedebusch[1], Jennifer S. McLeland[1], Aiad M. Zaza[3], Anne M. Fagan[1,2,4], Lena McCue[5], Chengjie Xiong[5], John C. Morris[1,2,4], Tammie L. S. Benzinger[3,4], David M. Holtzman[1,2,4]*

REGULAR RESEARCH PAPER

Effects of deep sedation on sleep in critically Ill medical patients on mechanical ventilation

Raymonde Jean[1] | Purav Shah[2] | Eric Yudelevich[3] | Frank Genese[4] | Katherine Gershner[5] | Daniel Levendowski[6] | Miguel Martillo[7] | Iazsmin Ventura[8] | Anirban Basu[9] | Pius Ochieng[10] | Charlisa D. Gibson[5]

Multimodal assessment of sleep in men and women during treatment for opioid use disorder

Patrick H. Finan[a,*], Chung Jung Mun[a], David H. Epstein[b], William J. Kowalczyk[b,1], Karran A. Phillips[b], Daniel Agage[b], Michael T. Smith[a], Kenzie L. Preston[b,**]

[a] Johns Hopkins University School of Medicine, Baltimore, MD, 21224, United States
[b] Intramural Research Program, National Institute on Drug Abuse, 251 Bayview Blvd., Suite 200, Baltimore, MD, 21224, United States

Can disrupted sleep affect mortality in the mechanically ventilated critically ill?

Shah PC[1], Yudelevich E[1], Genese F[1], Martillo M[1], Ventura I[1], Fuhrmann K[1], Mortel M, Levendowski D[2], Gibson CD[3], Ochieng P[1], Jean R[1]

Processed EEG monitoring for anesthesia and intensive care practice

Stefano ROMAGNOLI [1, 2] *, Federico FRANCHI [3], Zaccaria RICCI [4]

Sleep duration and architecture in non-intubated Intensive Care Unit patients: An observational study.

Stefano Romagnoli[1,2*], Gianluca Villa[1], Lorenzo Fontanarosa[2], Lorenzo Tofani[3], Fulvio Pinelli[2], A. Raffaele De Gaudio[1], Zaccaria Ricci[4].

Night to Night Variability in Sleep Architecture and Continuity in Patients Evaluated for Chronic Insomnia

Philip Westbrook[1], Daniel Levendowski[1], Mindy Cetel[2], Robert Rosenberg[3], Mari Hirst[3], Zoran Matic[1], Alexandra Cifelli[1]
Advanced Brain Monitoring, Inc.[1], Integrative Insomnia and Sleep Health Center[2], Sleep Disorders Centers of Prescott Valley and Flagstaff[3]

Sleep in the ICU: An Analysis of Sleep Quality and Quantity in Mechanically Ventilated Patients

Eric Yudelevich MD[1], Katherine Fuhrmann, DO[1], Iazsmin Ventura[1], *Miguel Martillo[1], Frank Genese, DO[1]*, Charlisa Gibson[2], Pius Ochieng MD[3], Raymonde Jean MD[3]

[1]Mount Sinai St Luke's and Mount Sinai Roosevelt Hospitals, Icahn School of Medicine New York, NY
[2]Division of Pulmonary and Critical Care at Montefiore Medical Center Bronx, NY
[3]Division of Pulmonary and Critical Care at Mount Sinai St Luke's and Mount Sinai Roosevelt Hospitals

Head Position During Sleep: Potential Implications for Patients with Neurodegenerative Disease

Daniel J. Levendowski[a,*], Charlene Gamaldo[b], Erik K. St. Louis[c], Luigi Ferini-Strambi[d], Joanne M. Hamilton[e], David Salat[f,g], Philip R. Westbrook[a] and Chris Berka[a]
[a]*Advanced Brain Monitoring, Carlsbad, CA, USA*
[b]*Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, USA*
[c]*Center for Sleep Medicine, Departments of Neurology and Medicine, Mayo Clinic College of Medicine and Science, Rochester, MN, USA*
[d]*Department of Clinical Neurosciences, San Raffaele Scientific Institute, Sleep Disorders Center Università Vita-Salute San Raffaele, Milan, Italy*
[e]*Advanced Neurobehavioral Health, San Diego, CA, USA*
[f]*Harvard Medical School, Boston, MA, USA*
[g]*Massachusetts General Hospital, Boston, MA, USA*

ASSESSMENT OF SLEEP ABNORMALITIES IN PATIENTS WITH NEURODEGENERATIVE DISEASE USING AN IN-HOME SLEEP PROFILING SYSTEM

Daniel Levendowski[1], Chris Berka[1], Amir Meghdadi[1], Greg Rupp[1], Stephanie Smith[1], Joanne Hamilton[2,3], David Salat[4,5], Kefron McCaw[2], Philip Westbrook[1]

CHARACTERIZATION OF SLEEP ABNORMALITIES IN ALZHEIMER'S DISEASE & MILD COGNITIVE IMPAIRMENT USING AN IN-HOME SLEEP PROFILING SYSTEM

Chris Berka[1], Daniel Levendowski[1], Amir Meghdadi[1], Greg Rupp[1], Marija Stevanovic Karik[1], Stephanie Smith[1], Joanne Hamilton[2,3], David Salat[4,5], Kefron McCaw[2], Philip Westbrook[1]

4. Sleep Profiler PSG2 [Internet]. [cited 2022 Jan 31].

Software do *Sleep Profiler*

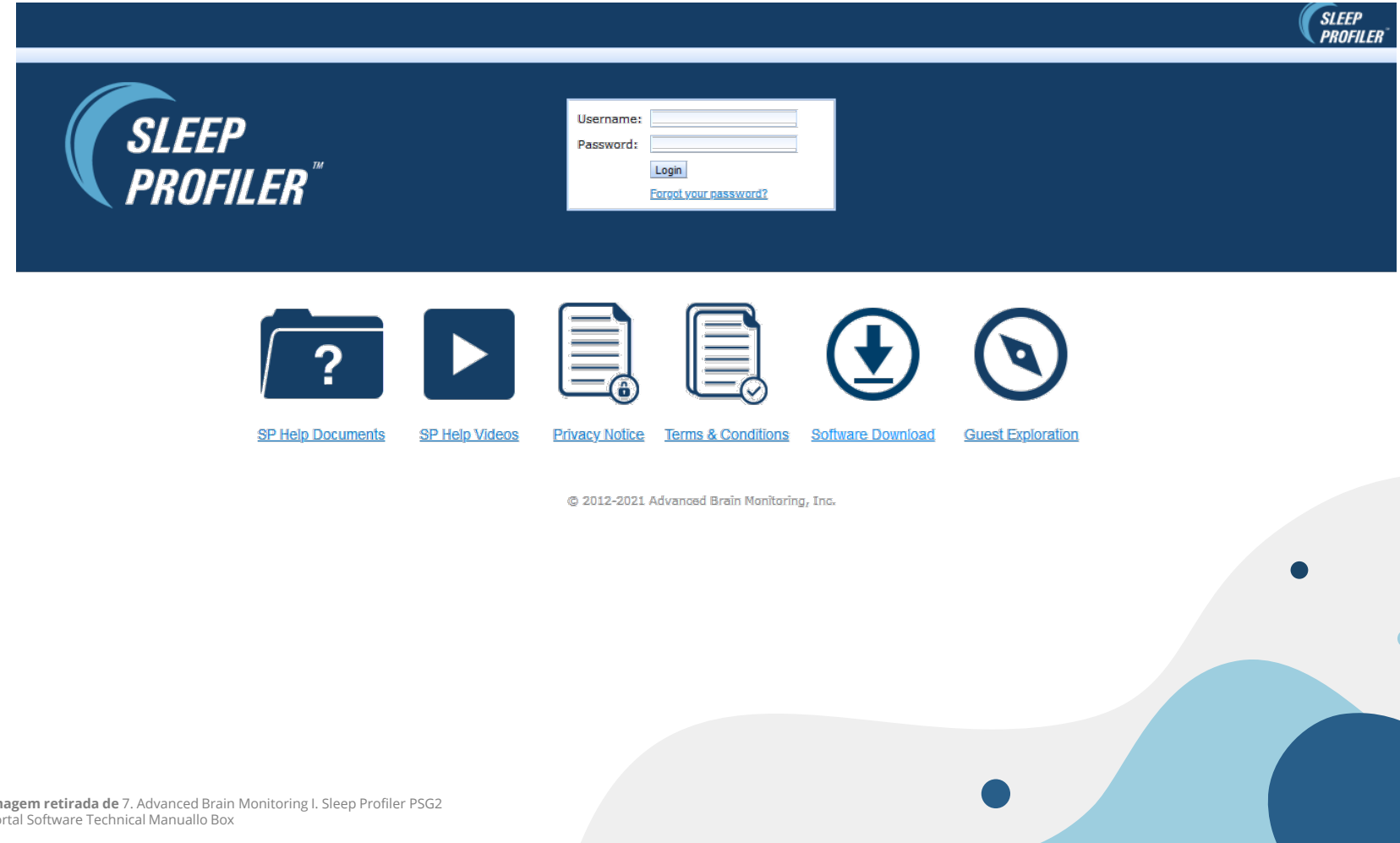
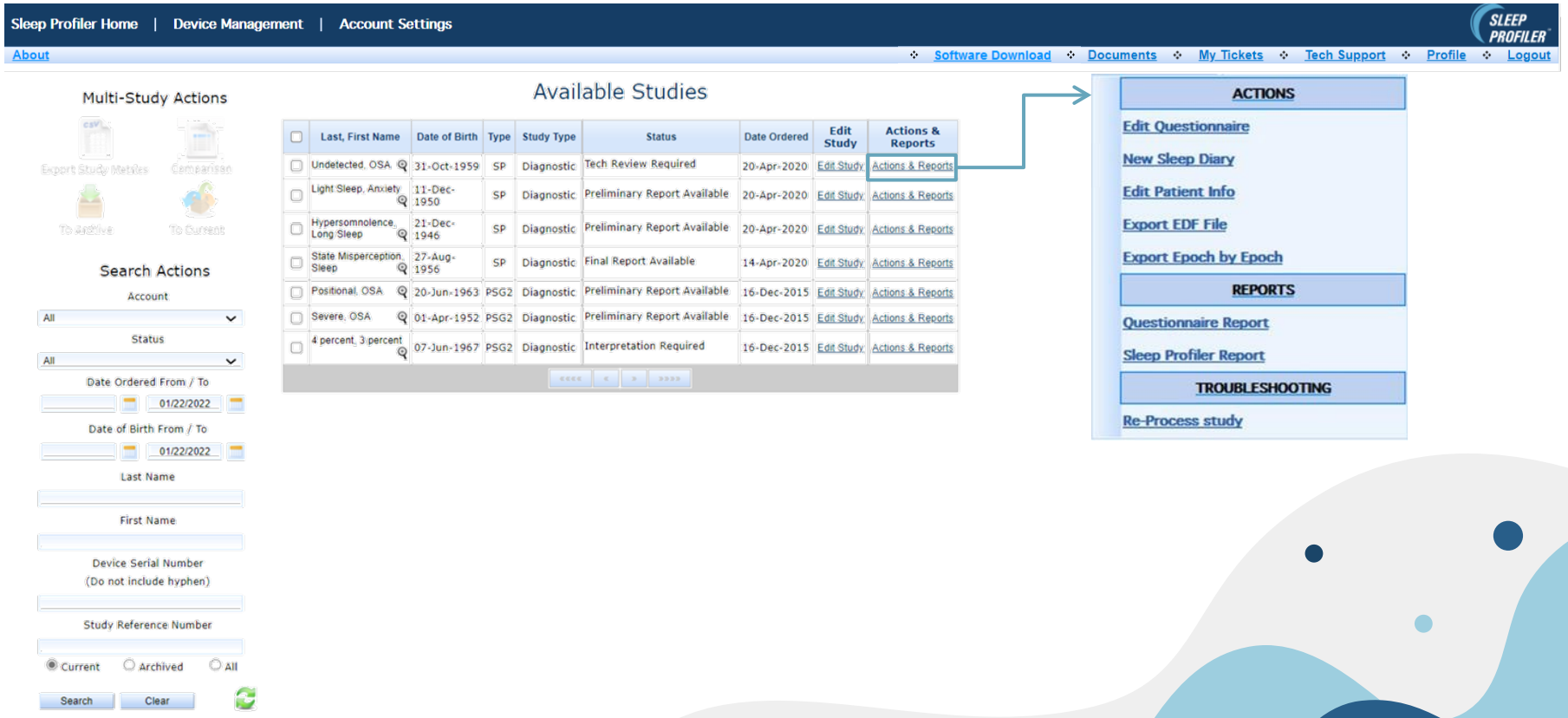
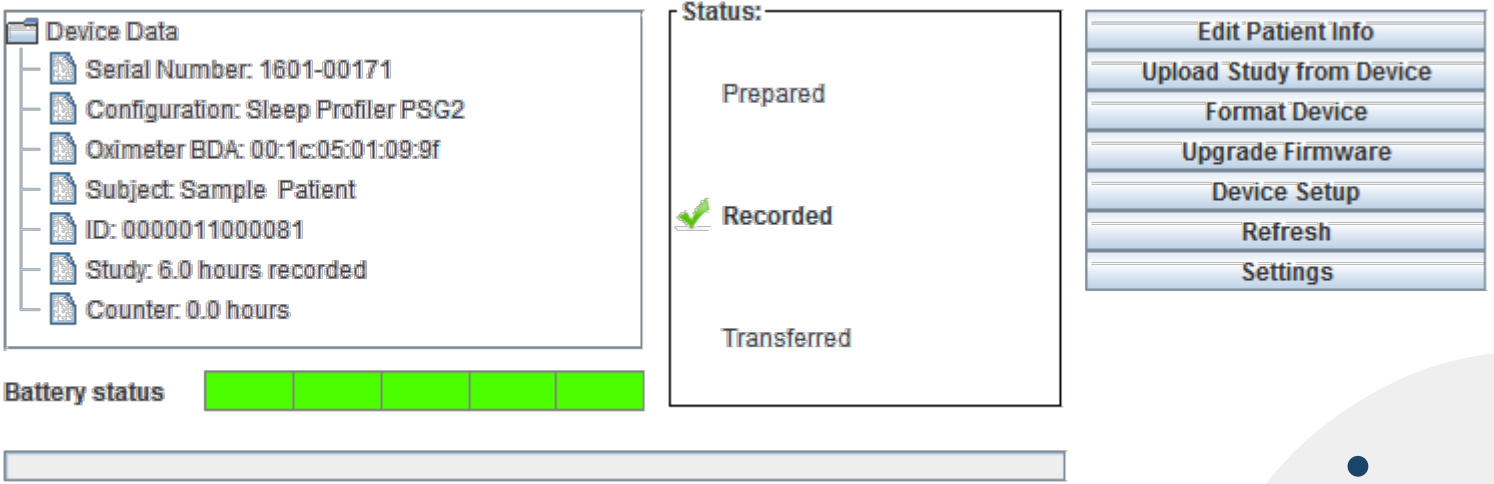


Imagem retirada de 7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box



Imagens retiradas de 7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Preparação do equipamento



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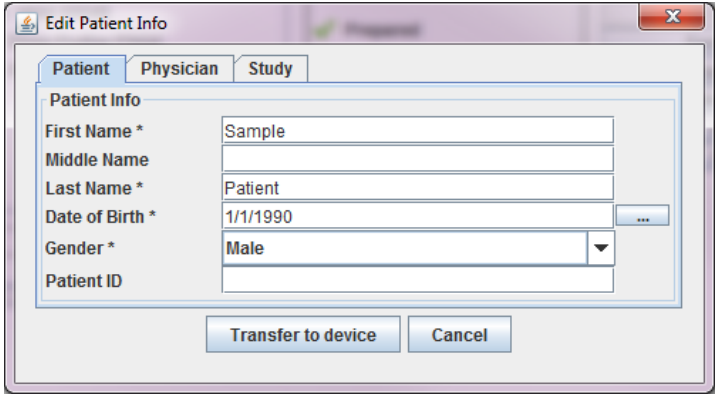
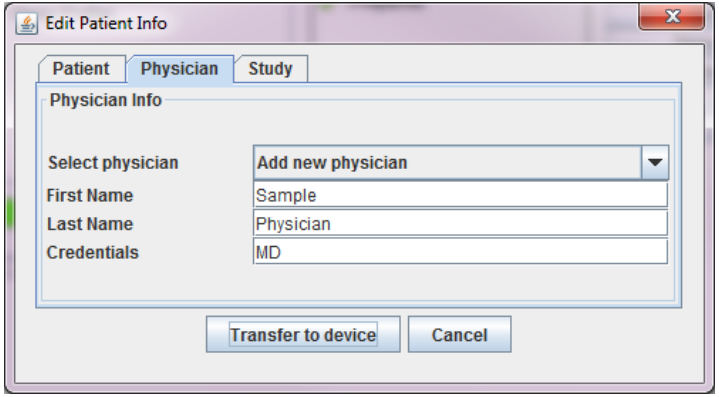
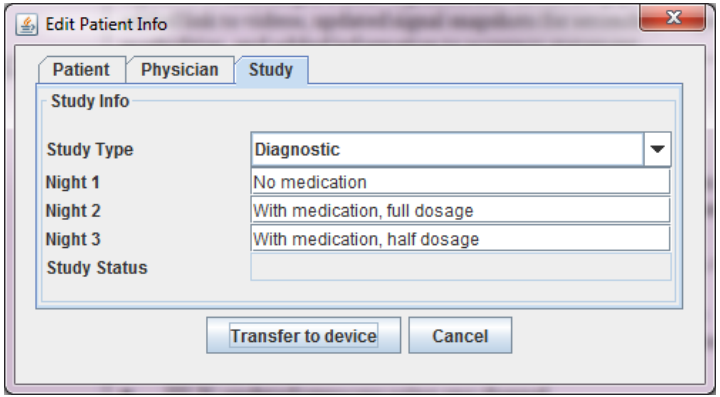
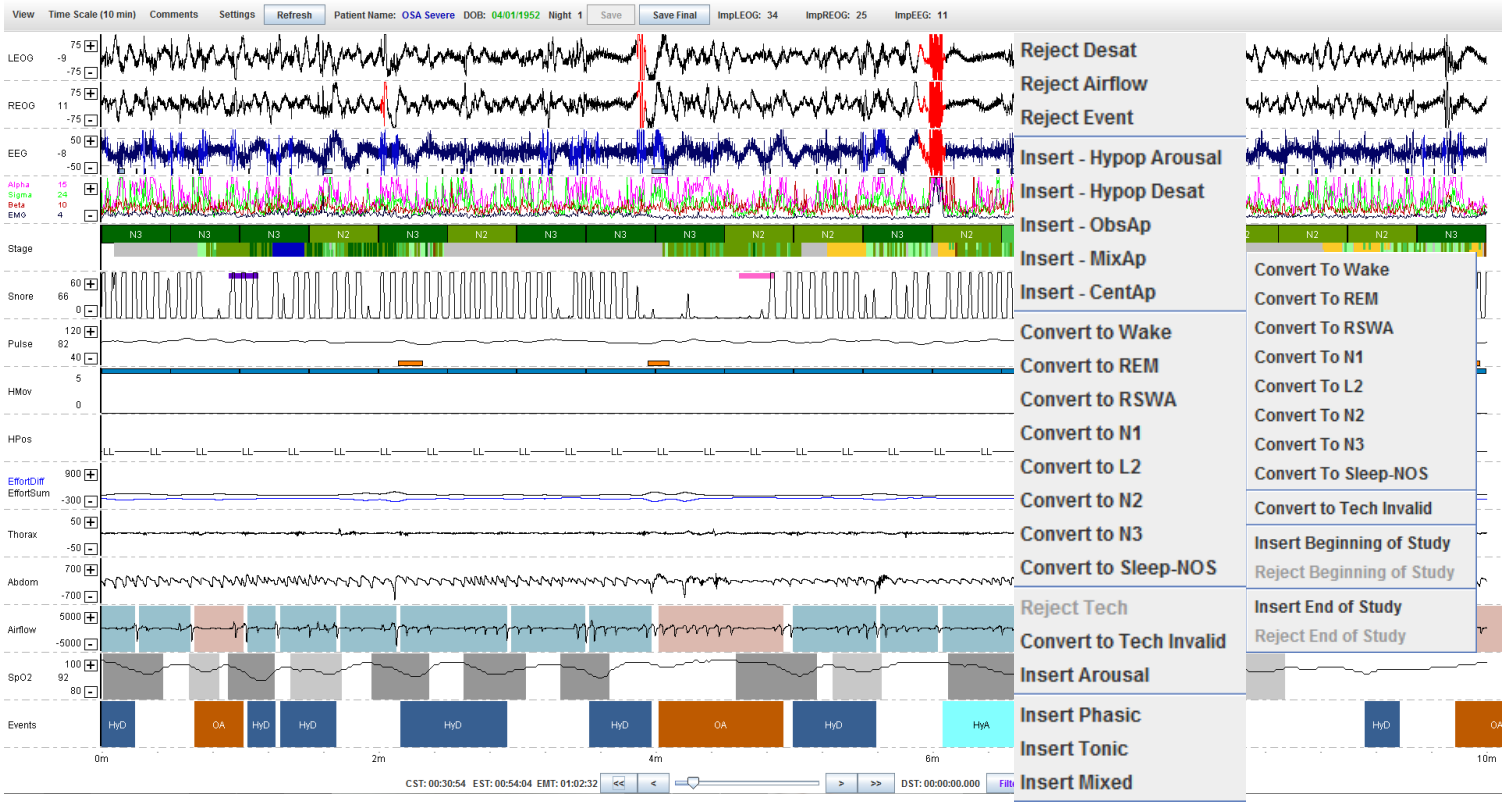






Imagens retiradas de 7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Visualização do estudo



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Comentários

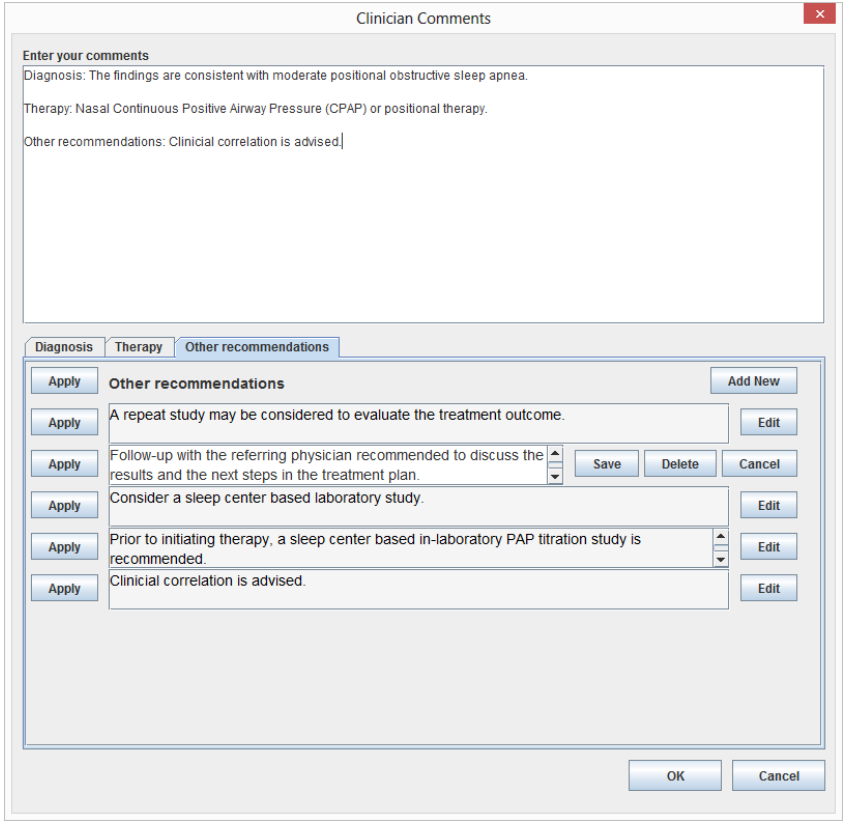
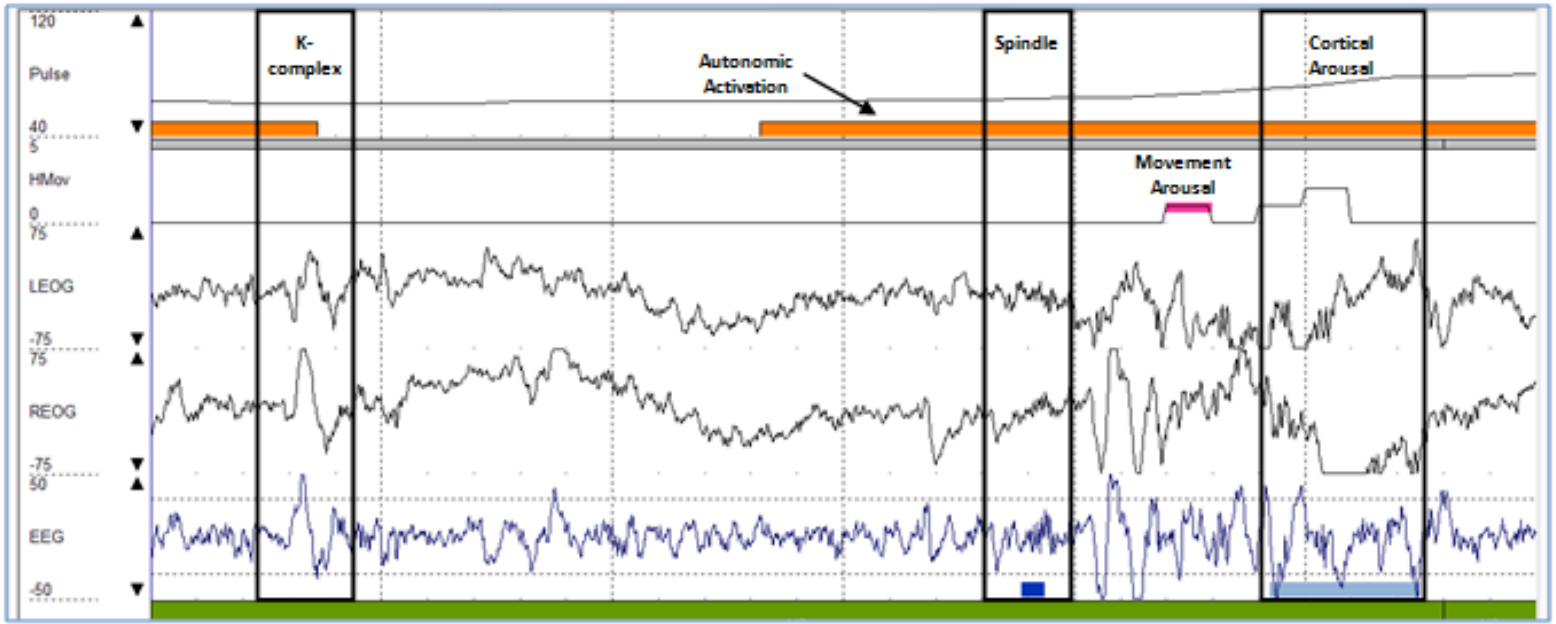


Imagem retirada de 7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Microdespertares



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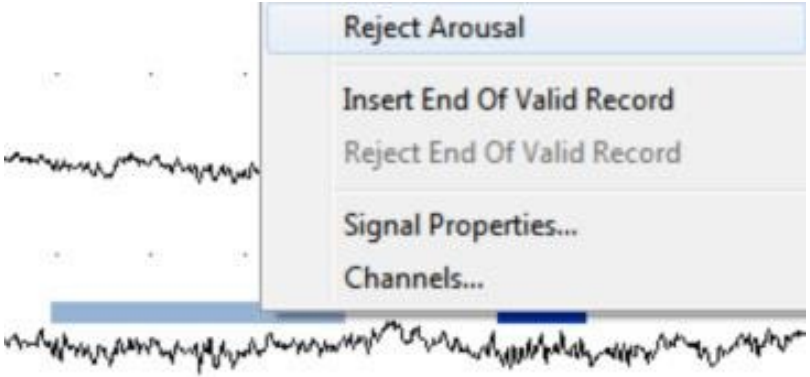

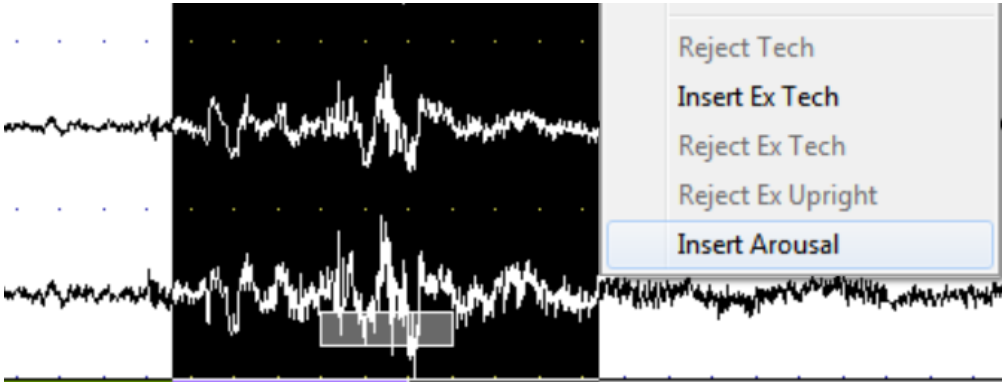

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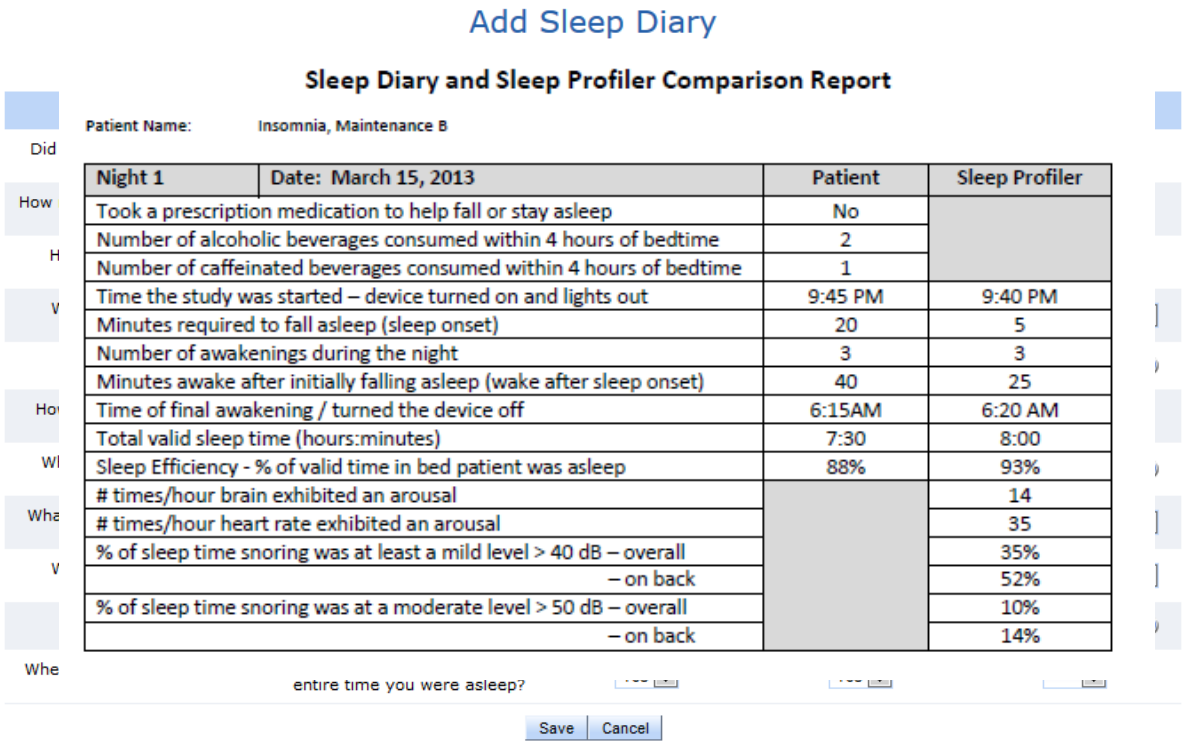
Questionário

- O Software do Sleep Profiler dispõe de um questionário dividido em:

Informação demográfica[7]	Condições diagnosticadas[7]	Questionário de Epworth[7]	Problemas de sono/insónia[7]
Hábitos[7]	Questionário sobre a saúde do paciente[7]	Distúrbios de Ansiedade Generalizada[7]	Medicação[7]

7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Diário de Sono



Add Sleep Diary

Sleep Diary and Sleep Profiler Comparison Report

Patient Name: Insomnia, Maintenance B

Night 1	Date: March 15, 2013	Patient	Sleep Profiler
Took a prescription medication to help fall or stay asleep		No	
Number of alcoholic beverages consumed within 4 hours of bedtime		2	
Number of caffeinated beverages consumed within 4 hours of bedtime		1	
Time the study was started – device turned on and lights out		9:45 PM	9:40 PM
Minutes required to fall asleep (sleep onset)		20	5
Number of awakenings during the night		3	3
Minutes awake after initially falling asleep (wake after sleep onset)		40	25
Time of final awakening / turned the device off		6:15AM	6:20 AM
Total valid sleep time (hours:minutes)		7:30	8:00
Sleep Efficiency - % of valid time in bed patient was asleep		88%	93%
# times/hour brain exhibited an arousal			14
# times/hour heart rate exhibited an arousal			35
% of sleep time snoring was at least a mild level > 40 dB – overall			35%
– on back			52%
% of sleep time snoring was at a moderate level > 50 dB – overall			10%
– on back			14%

entire time you were asleep?

Save Cancel

Imagens retiradas de 7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Relatório final

- No relatório está presente:

História Clínica[7]

Resultados obtidos no estudo[7]

Relatório dos comentários[7]

Resultados da arquitetura do sono[7]

Representação gráfica[7]

Estatísticas da Qualidade do Sono[7]

Relato do paciente[7]

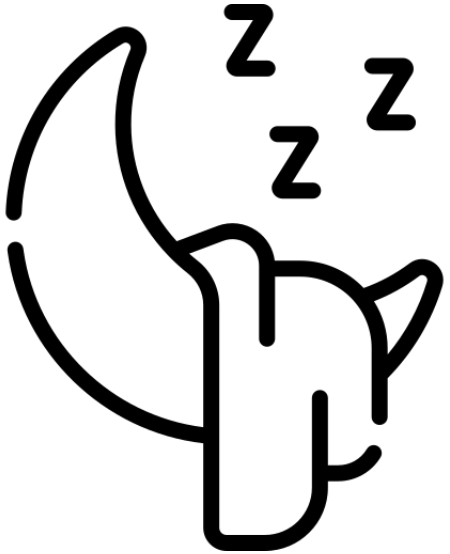
7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box

Considerações finais

- O Sleep Profiler PSG2™ permite:
  - ✓ Avaliação do sono menos dispendiosa e incómoda;
  - ✓ Colocação pelo paciente;
  - ✓ Maior acessibilidade;
  - ✓ Diagnóstico precoce.

Considerações finais

- Limitações:
  - ✕ Poucos estudos de validação;
  - ✕ Apenas um canal de EEG;
  - ✕ Apenas para adultos.



Referências

1. Chinoy ED, Cuellar JA, Huwa KE, Jameson JT, Watson CH, Bessman SC, et al. Performance of seven consumer sleep-tracking devices compared with polysomnography. Sleep [Internet]. 2021 May 1 [cited 2022 Jan 31];44(5). Available from: /pmc/articles/PMC8120339/

2. Rundo JV, Downey R. Polysomnography. Handb Clin Neurol. 2019 Jan 1;160:381–92.

3. Sleep Profiler [Internet]. [cited 2022 Jan 31]. Available from: https://www.advancedbrainmonitoring.com/products/sleep-profiler

4. Sleep Profiler PSG2 [Internet]. [cited 2022 Jan 31]. Available from: https://www.advancedbrainmonitoring.com/products/sleep-profiler-psg2

5. Levendowski DJ, Ferini-Strambi L, Gamaldo C, Cetel M, Rosenberg R, Westbrook PR. The accuracy, night-To-night variability, and stability of frontopolar sleep electroencephalography biomarkers. J Clin Sleep Med. 2017;13(6):791–803.

6. Finan PH, Richards JM, Gamaldo CE, Han D, Leoutsakos JM, Salas R, et al. Validation of wireless self application ambulatory EEG. J Clin Sleep Med [Internet]. 2016 [cited 2022 Jan 31];12(11):1443–51. Available from: https://advancedbrainmonitoring.app.box.com/s/j3mtk99h8yd8fhaqrxjr5iepgsglanr1

7. Advanced Brain Monitoring I. Sleep Profiler PSG2 Portal Software Technical Manuallo Box [Internet]. [cited 2022 Jan 31]. Available from: https://advancedbrainmonitoring.app.box.com/s/26ywta5m30ka4lpj61qydgr4r4glwgd4

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