

BSS International Sleep Medicine Course 2026

15th - 18th September | Newcastle

Assessment of Sleep Disorders and Diagnostic Procedures

Prof. Dr. Johan Verbraecken

Antwerp University Hospital and University of Antwerp (B)



British Sleep Society



UK Multidisciplinary Sleep Professionals



Nederlandse vereniging voor
SLAAP- EN WAAKONDERZOEK
www.nswo.nl



www.slaapgeneeskundevereniging.nl



Conflict of Interest Disclosures for Speakers

☐

1. I do not have any potential conflicts to disclose.

☒

2. I wish to disclose the following potential conflicts of interest:

Type of Potential Conflict	Details of Potential Conflict
Grant/Research Support	Aescubrand, AirLiquide, Bioprojet, Epilog, Inspire, Löwenstein Medical, Mediq, Micromed, Nyxoah, Philips, ProSomnus, ResMed, SomnoMed, SOS Oxygene, Sefam, Tilman, Total Care, Vivisol, Westfalen Medical, ZOLL Respicardia, VLAIO, Vlaamse Gemeenschap.
Consultant	Aurobindo, Azelis, Bioprojet, Procter & Gamble, SDWorx, TotalCare, Westfalen Medical, ZOLL.
Speakers' Bureaus	
Financial support	
Other	

☒

3. The material presented in this lecture has no relationship with any of these potential conflicts, **OR**

☐

4. This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:

- 1.
- 2.
- 3.

Assessment of sleep disorders

- Subjective assessment
- Objective assessment
- Future directions

Overview

- Assessment of complaints about disturbed sleep and daytime functioning: multidimensional
- Clinical interview:
 - Addressing the help request
 - Semi-structures interview (context, factors that disturb sleep, impact on others, nocturnal and daytime symptoms)
- PROMS:
 - Questionnaires
 - Sleep diaries
- Physical examination
- Objective assessment tools

Subjective assessment

Questionnaires: overview

Domain	Questionnaire	# Items	# Domains	Cut-off	Range
Sleep/wake *	Pittsburgh Sleep Quality Index (PSQI)	19	7	>5	0–21
	Insomnia Severity Index (ISI)	7	2	>14	0–28
	* Epworth Sleepiness Scale (ESS)	8	–	>10	0–24
SDB	Berlin Questionnaire	10	–	(*)	–
	STOP-BANG	8	–	>2	0–8
Health & Quality of life	Functional outcomes of Sleep Questionnaire (FOSQ)	35	5	–	5–20
	Calgary Sleep Apnea Quality of Life instrument (SAQLI)	40	4	–	–
	Medical Outcomes Study Short Form-36 (SF-36)	36	8	–	0–100
Other	* Fatigue Severity Scale (FSS)	9	–	–	9–63
	Hospital Anxiety and Depression Scale (HADS)	14	2	>10	0–42
	Beck Depression Inventory (BDI)	21	–	>19	0–63

(*) Frequent or persistent symptoms in >1 item

Pevernagie D et al Sleep Med Clin
2021;16(4):595-606

Note: not a substitute for a clinical interview

Questionnaires: insomnia severity index

1. Please rate the current (i.e., last 2 weeks) severity of your insomnia problem(s).

	None	Mild	Moderate	Severe	Very
a. Difficulty falling asleep:	0	1	2	3	4
b. Difficulty staying asleep:	0	1	2	3	4
c. Problem waking up too early:	0	1	2	3	4

2. How satisfied/dissatisfied are you with your current sleep pattern?

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
0	1	2	3	4

3. To what extent do you consider your sleep problem to interfere with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.).

Not at all interfering	A little	Somewhat	Much	Very much interfering
0	1	2	3	4

4. How noticeable to others do you think your sleeping problem is in terms of impairing the quality of your life?

Not at all noticeable	A little	Somewhat	Much	Very much noticeable
0	1	2	3	4

5. How worried/distressed are you about your current sleep problem?

Not at all worried	A little	Somewhat	Much	Very much worried
0	1	2	3	4

Add scores for all 7 items

Total score range: 0-28

Categories of scores:

- 0-7 = no clinically significant insomnia
- 8-14 = subthreshold insomnia
- 15-21 = clinical insomnia (moderate severity)
- 22-28 = clinical insomnia (severe)

Only Q 1a-c specifically deal with insomnia

Has been validated versus polysomnography.

Useful to assess changes over time/treatment effects

Morin CM. APA PsycNet Direct 1993

Questionnaires:

Epworth Sleepiness Scale (ESS)

<i>Situation</i>	<i>Chance of dozing</i>
Sitting and reading	_____
Watching TV	_____
Sitting, inactive in a public place (e.g., a theatre or a meeting)	_____
As a passenger in a car for an hour without a break	_____
Lying down in the afternoon to rest when circumstances permit	_____
Sitting and talking to someone	_____
Sitting quietly after lunch without alcohol	_____
In a car, while stopped for a few minutes in the traffic	_____

0 = *would never* doze
 1 = *slight* chance of dozing
 2 = *moderate* chance of dozing
 3 = *high* chance of dozing

Add scores for all 8 items
 Total score range: 0-24
 Clinically relevant cut-off: >10

Poor correlation with objective
 measures of sleepiness

ESS is useful to assess changes
 over time or with treatment,
 but not at short-term intervals

Questionnaires: Fatigue Severity Scale

	Strongly disagree (=1)						Strongly agree (=7)
My motivation is lower when I am fatigued							
Exercise brings on my fatigue							
I am easily fatigued							
Fatigue interferes with my physical functioning							
Fatigue causes frequent problems for me							
My fatigue prevents sustained physical functioning							
Fatigue interferes with carrying out certain duties and responsibilities							
Fatigue is among my three most disabling symptoms							
Fatigue interferes with my work, family, or social life							

Add scores for all 9 items
Range: 9-63, higher scores indicating worse fatigue severity
<22 = "normal" | 22-34 = mild-to-moderate | >34 = severe

Krubb LB. 1989

Subjective assessment

Sleep diary

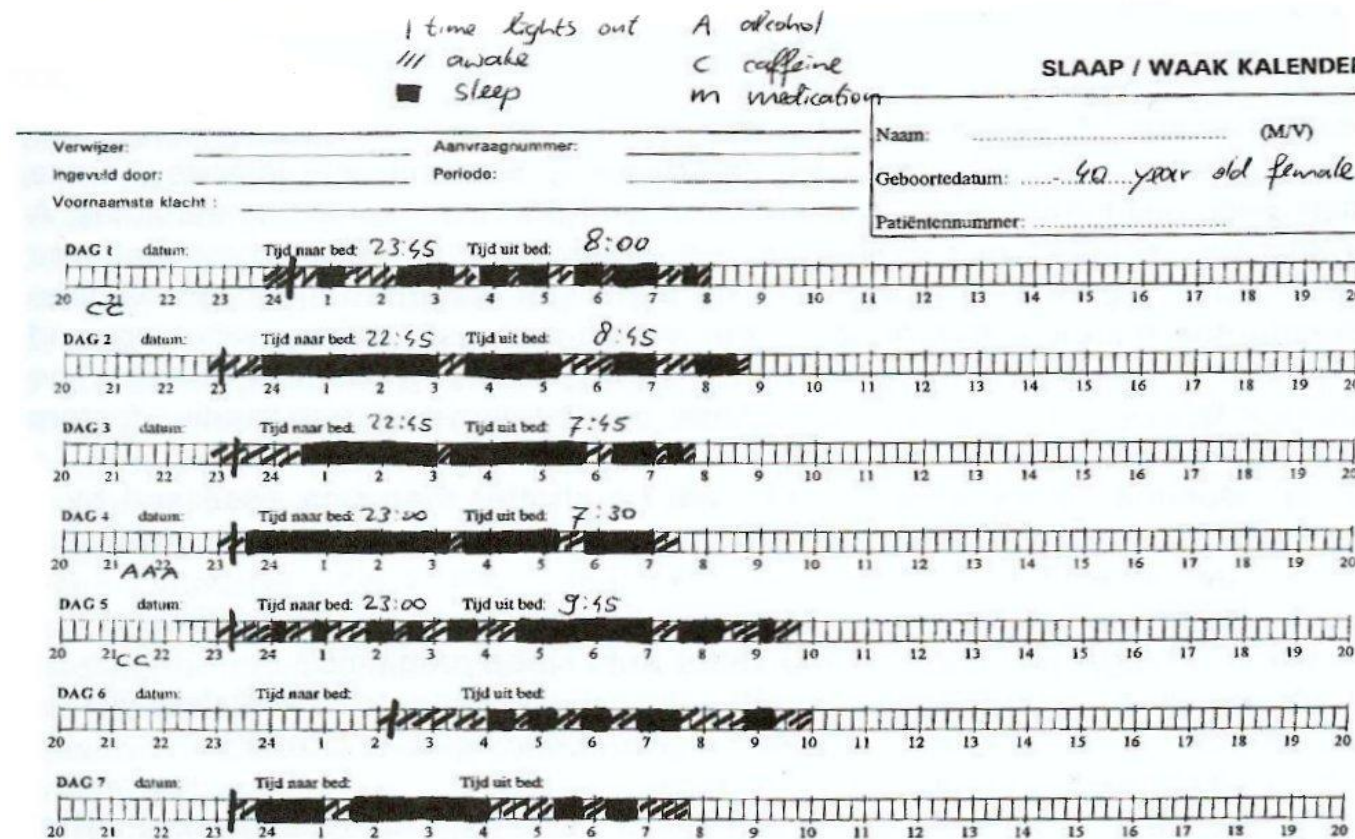
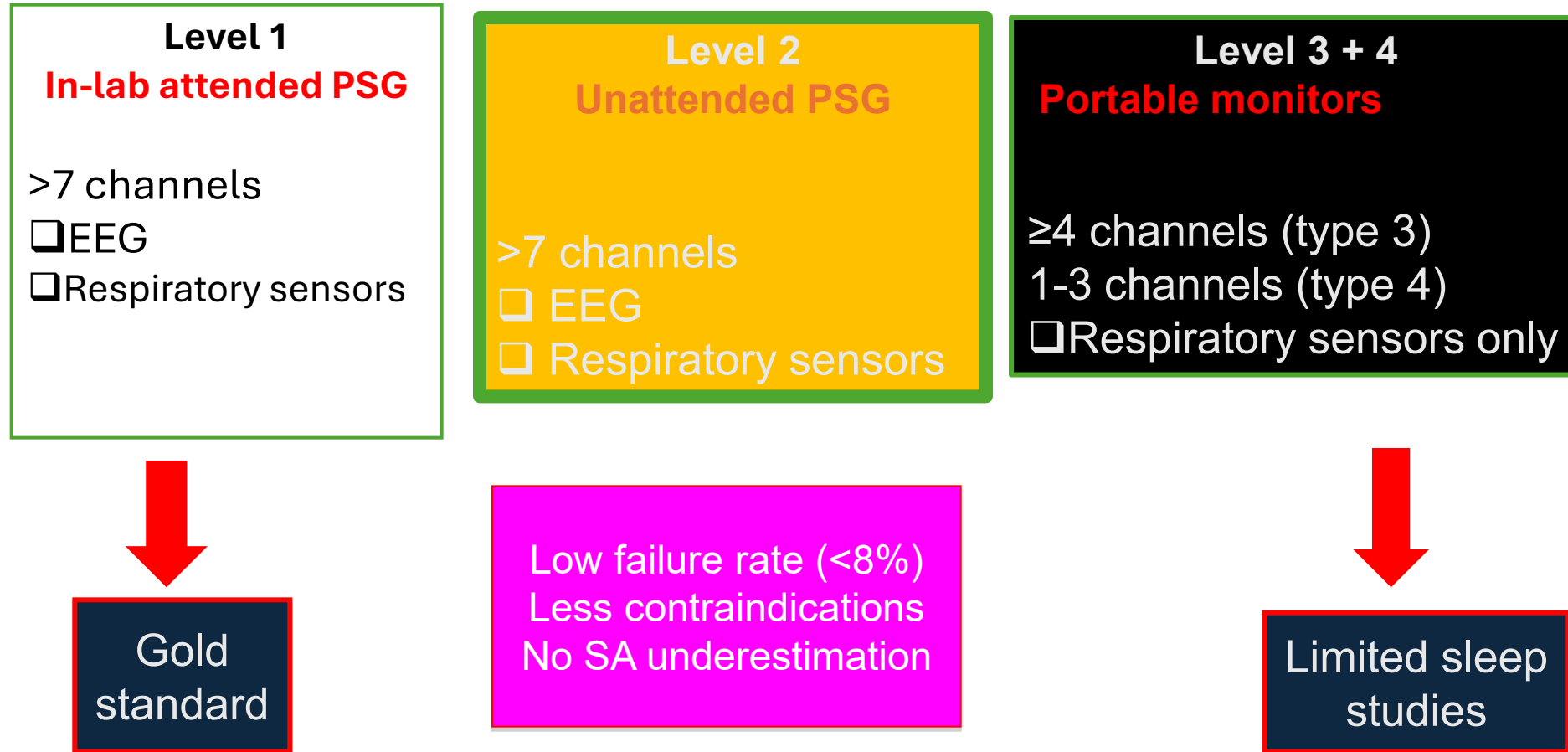


Figure 2: Example of a sleep log

Objective assessment

- **Assessment of sleep**
 - Poly(somno)graphy
- **Assessment of wakefulness**
 - Multiple Sleep Latency Tests (MSLT)
 - Other tests of wakefulness/sleepiness
- **Assessment of sleep timing**
 - Wrist Actigraphy
- **Clinical assessment**
 - Physical examination
 - Drug-Induced Sleep Endoscopy (DISE)

Diagnostic studies: levels (> 6h overnight recording)



Sleep 1994; 17: 372-7.
Sleep 2005. Practice Parameters for the
indications for PSG and related procedures.

STANDARD POLYSOMNOGRAPHY

Indications and Standards for Cardiopulmonary Sleep Studies.

ARRD 139: 559-568 (1989)

- EEG with at least 2 channels
- EMG chin muscles
- EOG with 2 channels
- **Microphone (snoring)**
- Airflow
- Movement thorax/abdomen
- Oximetry/**(CO2)**
- ECG
- **Sleep position**
- EMG OL
- **(video)**

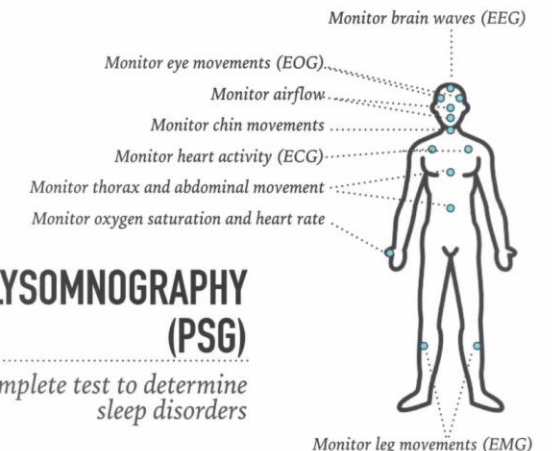
Sleep signals

Respiration

Movement

POLYSOMNOGRAPHY (PSG)

Complete test to determine
sleep disorders







PSG: self-applied EEG (Nox)

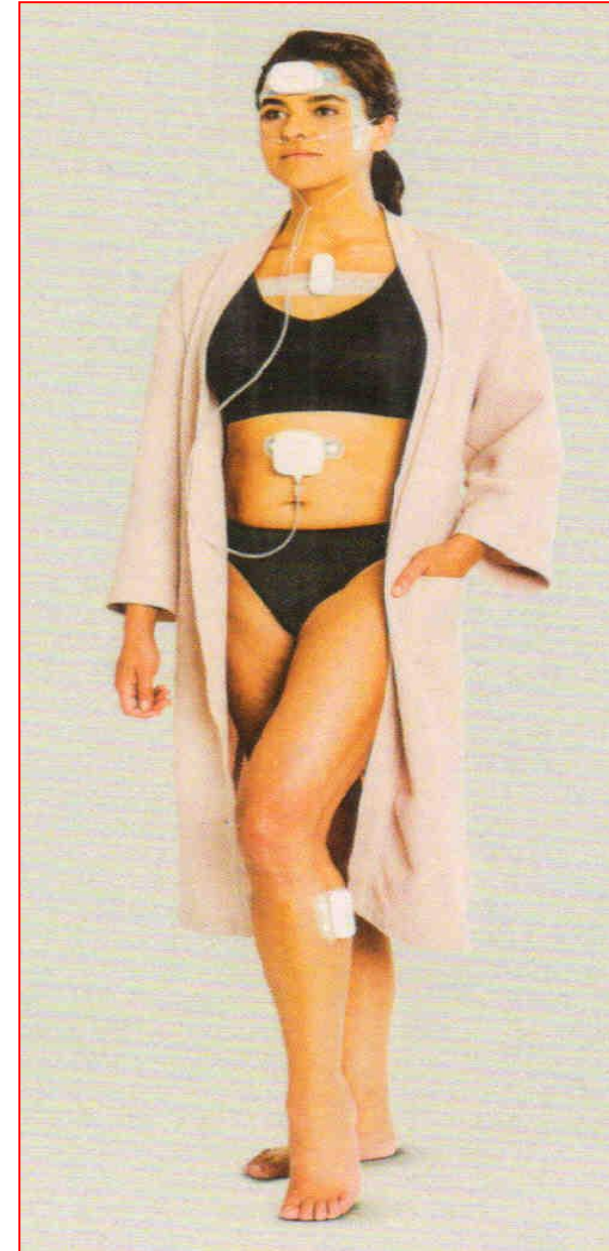


Comparison of EEG signal characteristics between polysomnography and Self Applied Somnography setup in a pediatric cohort

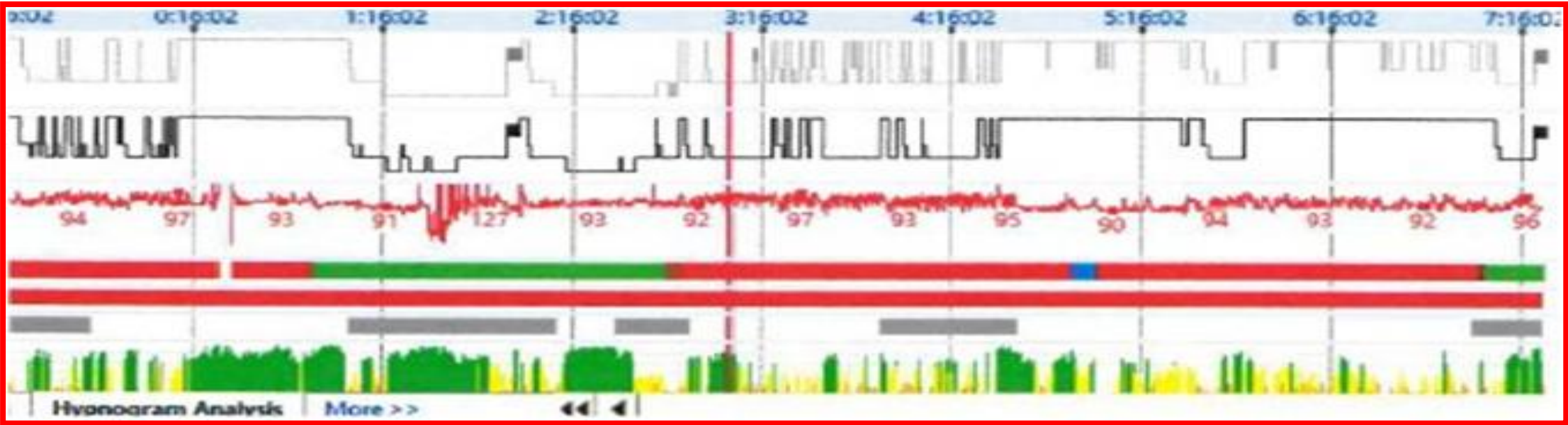
Samu Kainulainen^{1,2*}, Henri Korkalainen^{1,2*}, Sigríður Sigurðardóttir³, Sami Myllymaa^{1,2}, Marta Serwatko³, Sigurveig Þ. Sigurðardóttir^{5,6}, Michael Clausen^{7,8}, Timo Leppänen^{1,2,#}, Erna Sif Arnardóttir^{3,4,#}

IEEE 2021

Wireless PSG (Onera)



PSG: improvement in scoring algorithms based on AI



		Predictions					
		W	N1	N2	N3	R	
Expert labels	W	14.7	1.0	1.0	0.0	0.5	17.2
	N1	1.4	2.5	3.5	0.0	0.8	8.2
	N2	0.6	0.7	39.4	2.3	0.9	43.9
	N3	0.0	0.0	2.8	12.2	0.0	15.0
	R	0.2	0.2	1.3	0.0	13.9	15.6
		16.9	4.4	48.0	14.3	16.1	82.7

82.7 % matching
with manual PSG
analysis

Van der Plas D et al Front Digit Health 2021;3:707589



Polysomnography

PSG: advantages

1. To insure sleep
2. To insure REM sleep
3. To avoid scoring of events in wakefulness
4. Accurate diagnosis of sleep disorders and accurate diagnosis of comorbid sleep disorders
5. To detect EEG arousals
6. To provide a denominator for AHI

Limitations

Costly

Waiting times

Discomfort for the patient

First-night effect

Indications

Diagnosis of SRBD, parasomnia, movement disorders, nocturnal seizures

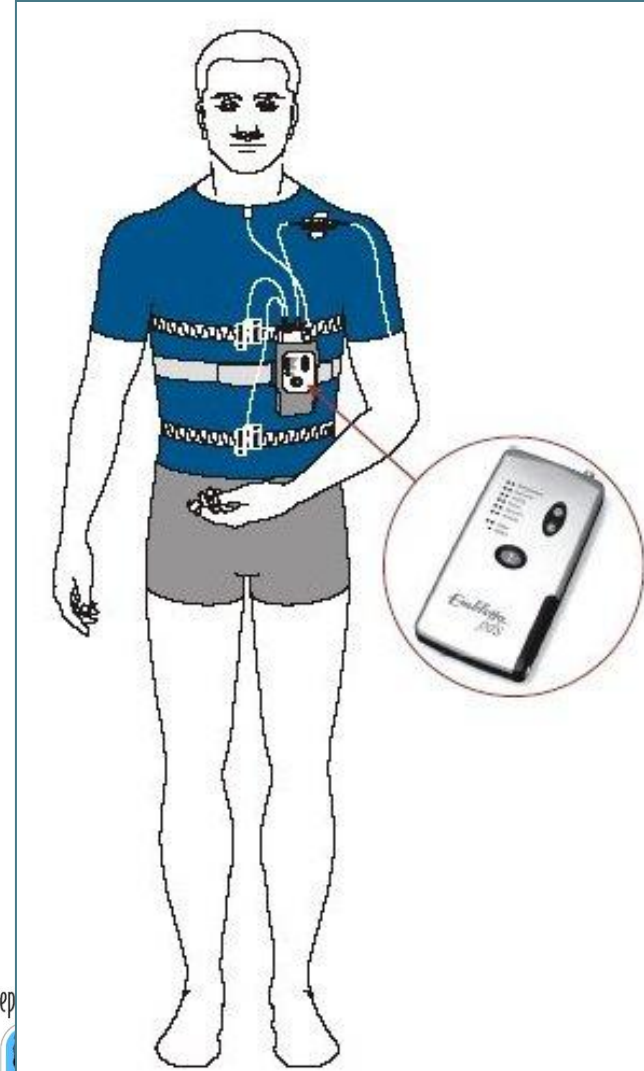
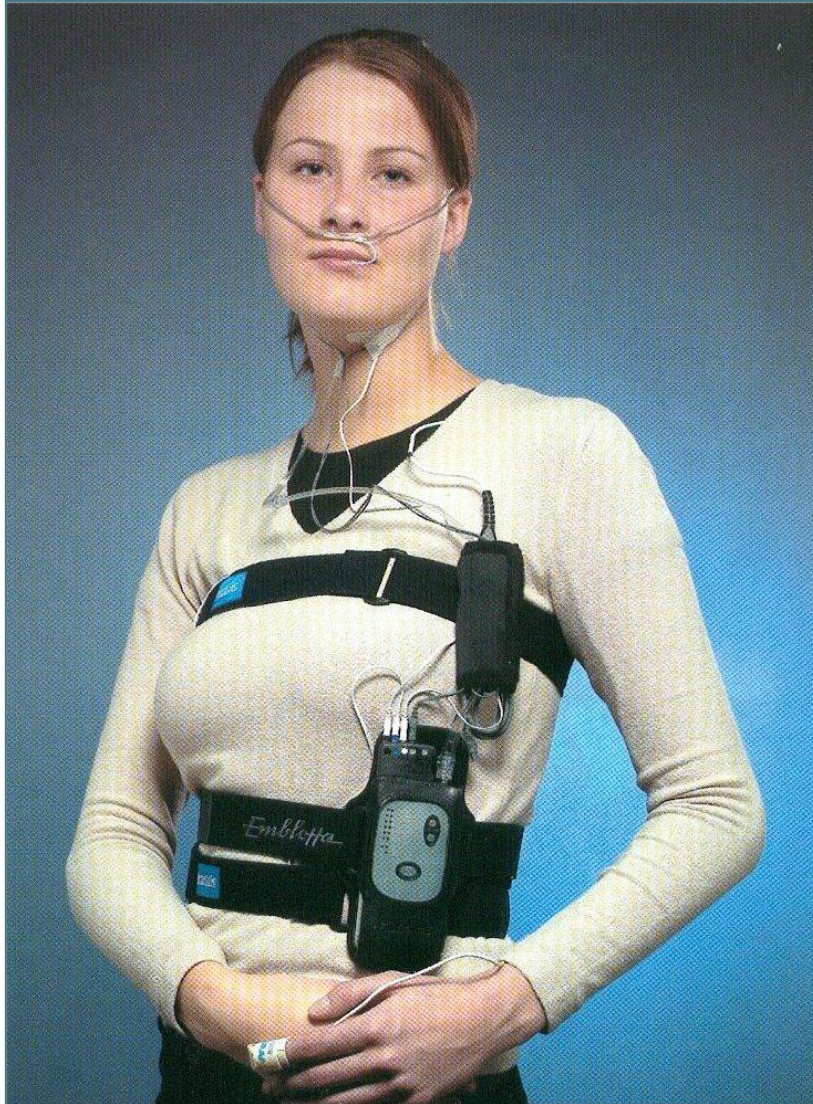
Useful in conditions with unexplained EDS

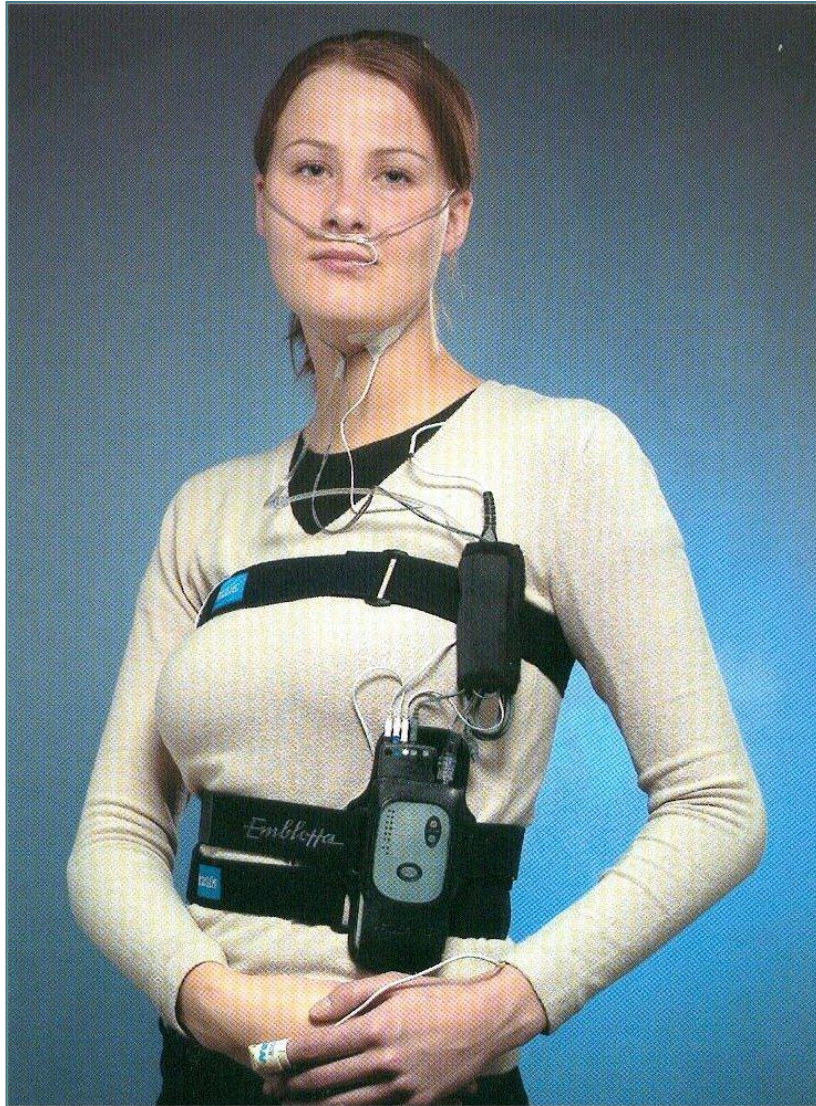
Exclusion of (comorbid) sleep disorders

Not for diagnosis of insomnia and circadian sleep-wake rhythm disorders

Objective assessment: ambulatory polygraphy

BSS ISMC 2026





Polygraphy

PG: advantages

1. Low cost
2. High accessibility
3. Ambulatory monitoring in home setting

Limitations

Only for sleep apnoea
Not suitable for other or comorbid sleep disorders

Main indication

High probability of obstructive sleep apnoea without comorbidities

Diagnostic tools Obtrusive techniques

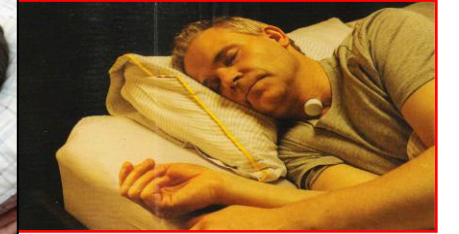
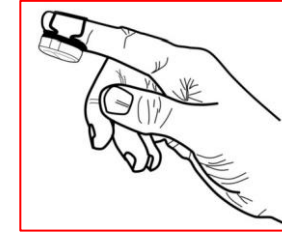


Less obtrusive techniques



Nonobtrusive techniques

Smart non-contact systems
Image processing technologies
Mattress sensor techniques



Objective assessment of *sleepiness*

- Multiple sleep latency test (MSLT)
- Maintenance of Wakefulness Test (MWT)
- Psychomotor Vigilance Test (PVT)
- Osler Test
- Driving simulation tests

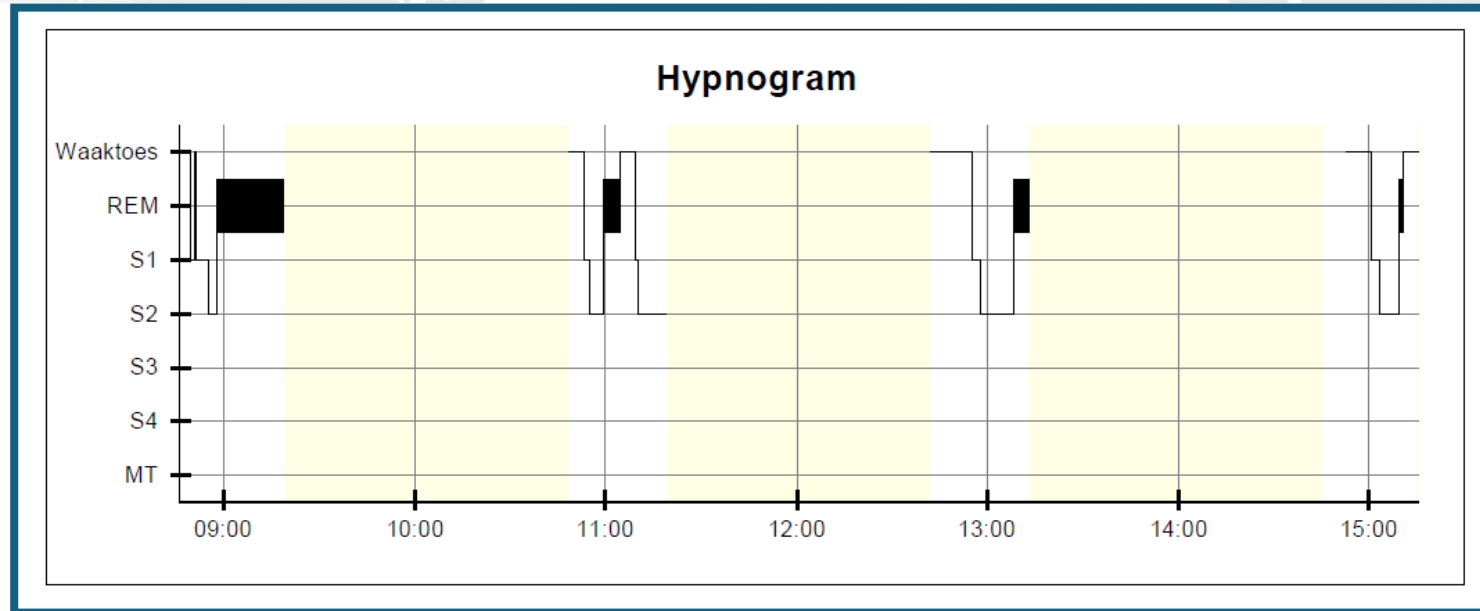
MSLT

- Commonly used method to assess sleepiness (in sleep promoting conditions)
- 4-5 naps (20 min opportunity to fall asleep)
- 1st nap 1.5h-3h after morning awakening on PSG
- Two-hour interval between each nap
- EEG, EOG, submental EMG
- Optimal sleep conditions
- After 1 night PSG
- Eventually sleep diary/actigraphy preceding MSLT

MSLT

- Mean Sleep Latency (MSL) of all naps
- Sleep onset REM sleep (within 15 min of sleep onset)
- Clinical context (sleep diary, history, medication, symptoms, sleep deprivation)
- $MSL < 8$ min on MSLT: prerequisite for diagnosis of narcolepsy or idiopathic hypersomnia

Mean Sleep Onset Latency	
<5 min	Clear sleepiness
5-8 min	Mild-moderate sleepiness
8-10 min	Grey area
>10 min	No sleepiness



MSLT								
Number of SLT's		5						
SLT#	Start	Stop	Duur	B. Sleep	Latentie	Lat. S1	Lat. S2	Lat. REM
1	08:46	09:18	00:31:51	08:49	00:03:29	00:03:29	00:08:59	00:11:29
2	09:18	09:18	00:00:02	09:18	00:00:00			00:00:00
3	10:49	11:19	00:30:04	10:53	00:04:15	00:04:15	00:06:15	00:10:15
4	12:42	13:12	00:30:31	12:54	00:12:35	00:12:35	00:15:35	00:26:05
5	14:45	15:15	00:29:41	15:00	00:14:51	00:14:51	00:17:51	00:23:51
Gemiddelde					00:07:02	00:08:48	00:12:10	00:14:20

SL 7 min; 4x REM (2x SOREM)

MSLT

- **Indications**

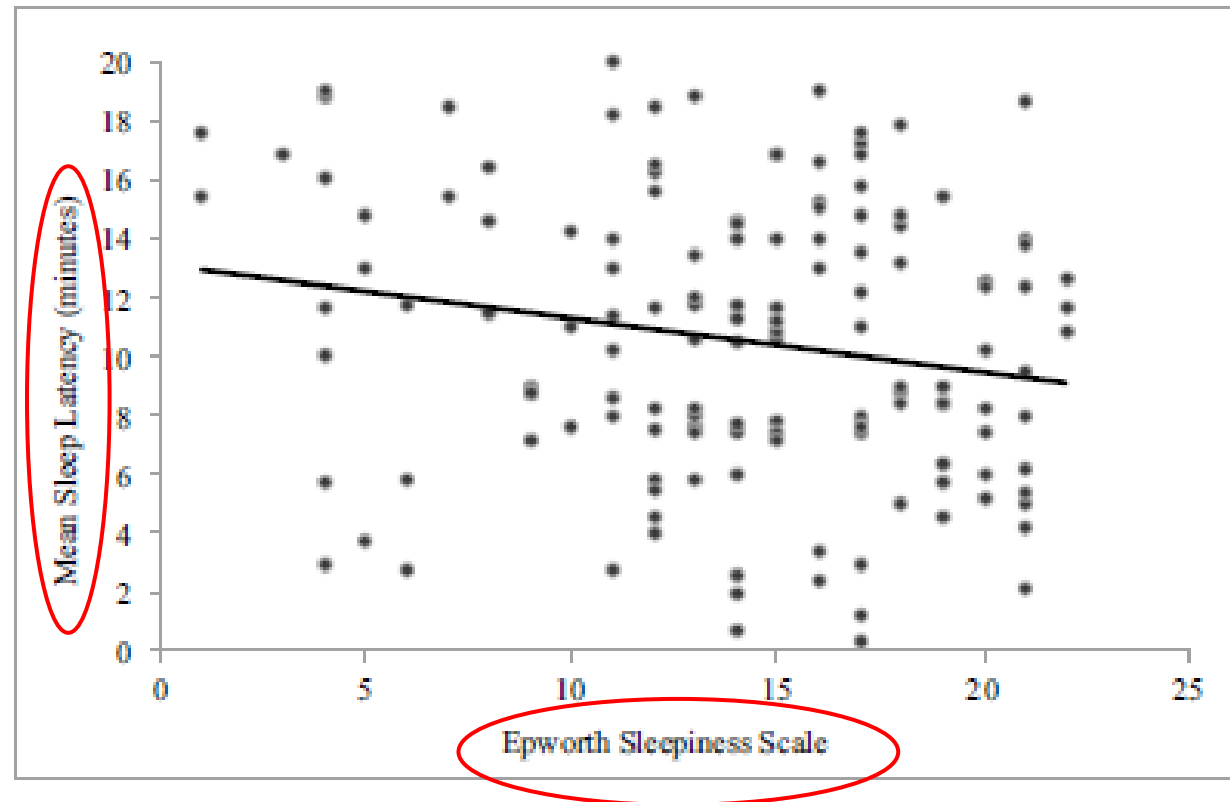
- Suspected narcolepsy or idiopathic hypersomnia
- Not for insomnia, sleep apnoea, circadian rhythm disorders, dissomnia due to psychiatric or medical disorder

- **Limitations**

- Not a test to test ability to stay awake
- Not a test for fitness to drive
- *Poor correlation with subjective sleepiness*
- False negative results

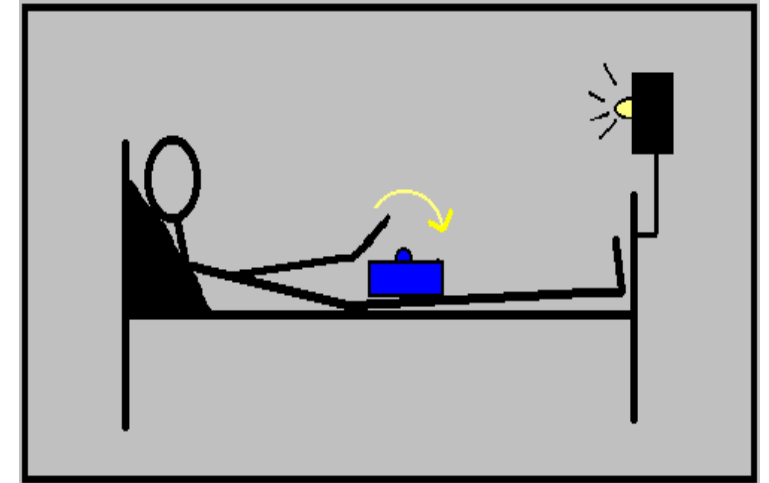
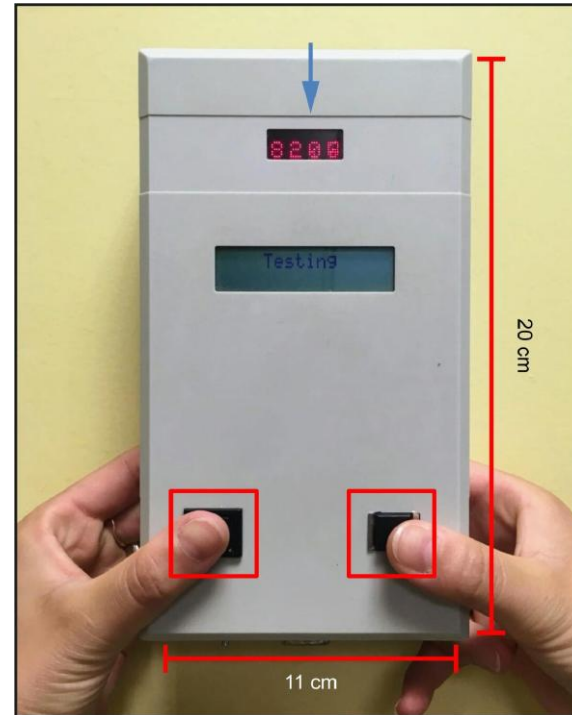
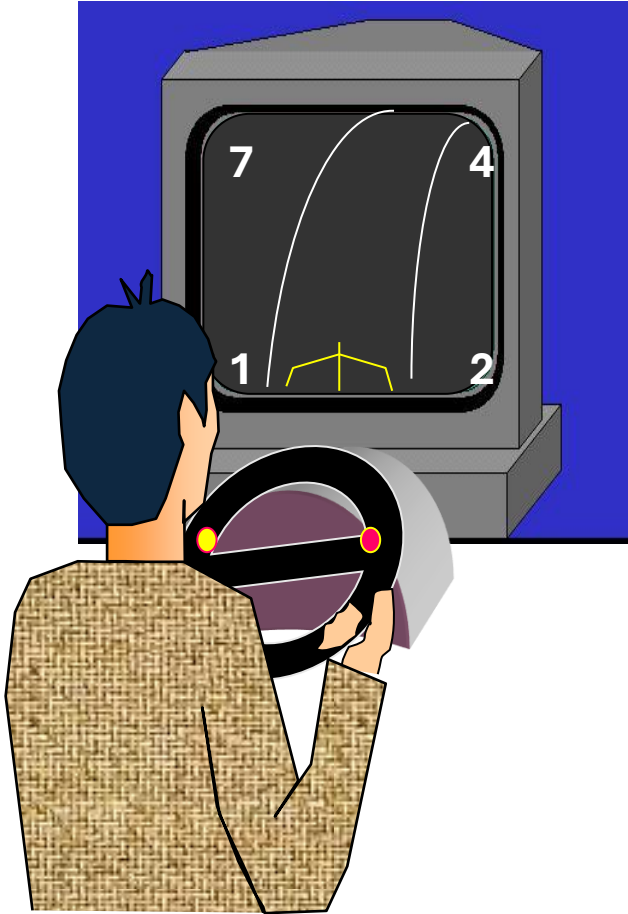
Poor correlation between ESS and MSLT

$R = -0.194$
 $P = 0.02$



Landzberg D et al. Sleep Breath
2022;26:1471–7

Other vigilance tests



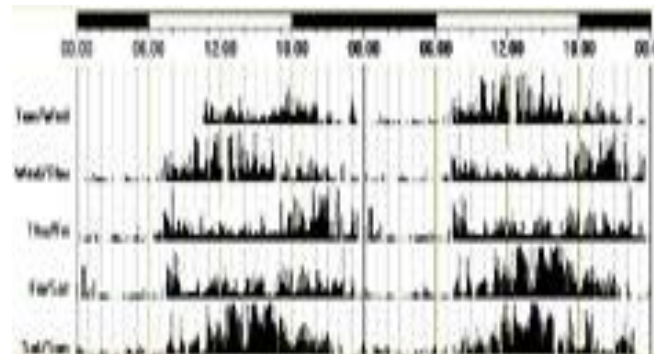
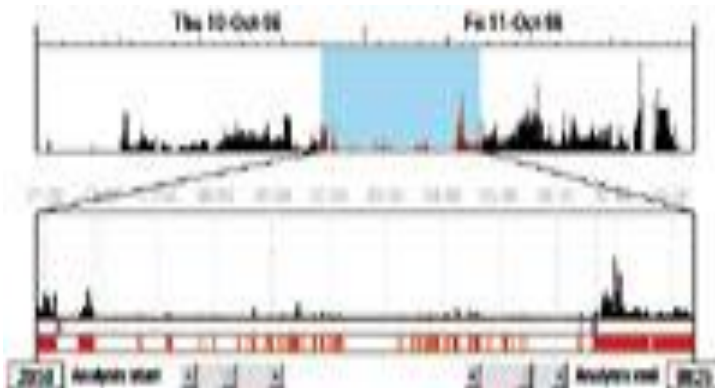
Maintenance of Wakefulness Test(MWT)
Driving simulation tests
Psychomotor Vigilance Test(PVT)
Osler Test



Actigraphy



- Wrist-worn movement detector
- Non-dominant arm
- At least 7 consecutive days, preferably 14 d
- In combination with (sleep) log
- Data processed by computer



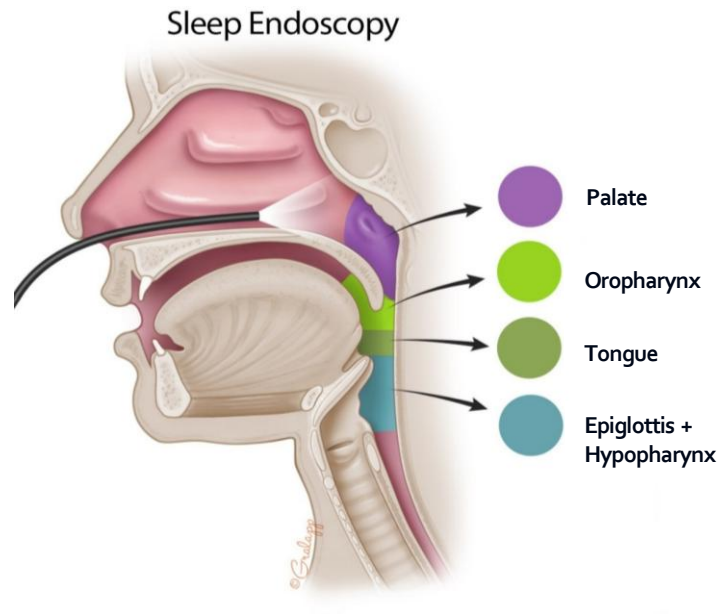
Non-invasive
Well-tolerated
Low cost
Objective data over
long time periods

Littner M et al. Sleep 2003;26(3):337-41

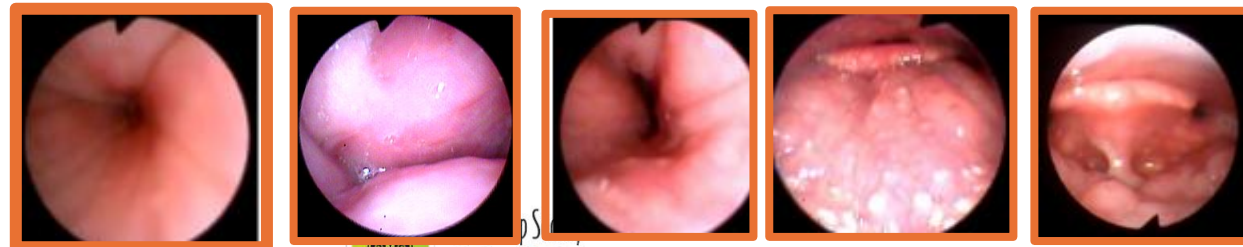
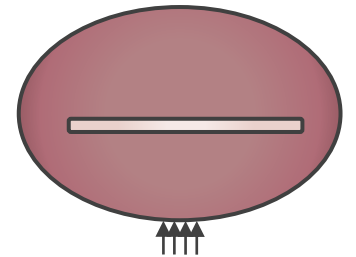
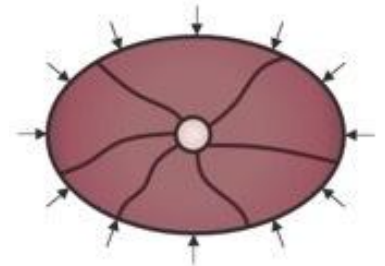
Actigraphy

- Derived parameters:
 - TST, TWT, %Sleep, %Wake, awakenings, sleep bouts, sleep fragmentation index
- Indications
 - Diagnosis of circadian SW rhythm disorders and insufficient sleep syndrome
 - Additional information in insomniacs and EDS
 - Not useful to diagnose OSA

Drug-Induced Sleep Endoscopy (DISE)



Sedation with propofol/midazolam
 Site and type of collapse
 Chin lift manoeuvre to assess the effect of jaw position



Conclusions

- Subjective evaluation is the starting point for the assessment of sleep disorders
- Based on subjective assessment, a working hypothesis as to the presumed diagnosis has to be made
- Objective assessment has to be performed to confirm or refute the presumed diagnosis.
- PSG is the gold standard. PG only if high pretest probability to find OSA.
- Clinical judgement is paramount for adjusting diagnostic and therapeutic decisions.



JOHAN VERBRAECKEN, BERTIEN BUYSE,
HANS HAMBURGER, VIVIANE VAN KASTEEL,
REINDERT VAN STEENWIJK (EDS.)

Sleep and Sleep Disorders *A Practical Handbook*

acco

www.acco.be/sleep

- **ISBN 9789463791311**
- **3 March 2020**
- **864 pages**
- **€ 144,75**

