Ying-Yang of Sleep
Shift Work in the Sleep Center &
An Update on Home Sleep Testing

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Educational Objectives
• To describe the impairing effects of shift work disorder
• To identify behavioral strategies to better cope with shift work
• To learn about the benefits of home sleep testing
• To name the contraindications for an unattended home sleep testing

Disclosures
• I am a full time sleep physician and an employee of the Sleep Wellness Institute.
• I do not have any other financial conflicts of interest to report.

SHIFT WORK IN THE
SLEEP CENTER

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Defining Sleep
• Species specific behavior characterized by a state of immobility with greatly reduced responsiveness.
• Distinguished from coma or anesthesia by its rapid reversibility.
• The timing and duration of sleep are species specific and determined by a circadian process and a homeostatic sleep pressure.

Homeostatic and Circadian Processes: Two Process Model

Siegel J. Nature 2005
www.medscape.com
Sleep Hypnogram

Functional Neuroanatomy of Wakefulness & Sleep

Sleep & Memory

Sleep & Endocrine Function

Shift Work Disorder (SWD)
- Shift work = Non-standard work schedules
  - Permanent or intermittent night work = Sleep Technologies
  - Early morning work
  - Rotating schedules
- Development of sleep disturbances
- Impairment of waking alertness and performance
- Individual differences in susceptibility to SWD (phase tolerance)
- 20% of U.S. workers are involved in some form of shift work
- Percentage of workers with SWD is unknown
Chronic Insomnia

- Sleep disturbance > 30 days:
  1. Difficulty in initiating sleep
  2. Difficulty in maintaining sleep
  3. Waking up too early
- Adequate opportunity and circumstances for sleep
- Daytime disturbances

Schulze-Rodin et al. JCSM, 2008

Sleepiness

- Propensity to fall asleep
  - i.e.: sleep deprivation, narcolepsy, obstructive sleep apnea, shift work, drugs
- Objective ≠ Subjective
- Objective measurement
  - Multiple Sleep Latency Test (MSLT)
- Subjective measurement
  - Epworth, Stanford scales

Shen, Sleep Med Rev, 2006

Fatigue

- Overwhelming sustained sense of exhaustion and decreased capacity for physical and mental work
- Classification
  - Acute vs. chronic
  - Physiological vs. psychological
  - Central vs. peripheral
- Treatment of choice is non-pharmacological

Shen, Sleep Med Rev, 2006

Alertness

- Capacity to stay awake
- Objective ≠ Subjective
- Objective measurement
  - Maintenance of wakefulness test 40 minute protocol [MWT-40]

Littner, Sleep, 2005

Determinants of Impaired Performance

- Sleep Deprivation
- Circadian Phase
- Time on Task

Homeostatic Quantification of Sleep Need

Homeostatic sleep deprivation model:
- 8-hour and 14-hour nights
- Total sleep over 28 days

Adapted from: Wehr et al, 1983
Effects of Sleep Deprivation on the Brain

Subjective-Objective Discrepancy

Detection of “Microsleeps”

Metabolic Changes: 4 Hours of Sleep

Partial Sleep Loss: Metabolic Consequences

- Leptin
- Ghrelin
- Cortisol
- Growth Hormone
- Catecholamines
- Insulin secretion (resistance)

Partial Sleep Loss: Metabolic Consequences

- Altered glucose metabolism.
- Increased appetite.
- Unhealthy food choices.
- More time to eat.
- Reduced energy expenditure.
- Reduced physical activity.
Sleep Duration & Obesity

Singh et al. JCSM 2005

Sleep Duration & BMI

Singh et al. JCSM 2005

Starting as a Sleep Technologist

... A Few Years Later

Performance Errors


Vehicle Accident Data

Schematic of Accidents, Errors, and Body Temperature Rhythm

Two Processes Combine to Determine Sleep Propensity and the Duration of Sleep

Relative Risk of Fatigue Crash By Hours Driving, TIFA 1991-1996

The Main Problem
- Working full time at night
- Enjoying / working day hours
- Chores / errands
- Caring for children / sick family
- Second job
- Leisure activities
- Putting sleep last

Evaluation
- Clinical interview and physical exam
- Predominant insomnia symptoms
- Predominant hypersomnolence → sleep deprivation?
- Sleep logs
- Actigraphy
- Polysomnography is NOT routinely indicated
- Ancillary laboratory / imaging testing is NOT indicated

Management
- Patient centered (individual circumstances)
- Behavioral measures
- Pharmacological
Behavioral Management

- Obtaining an **adequate** amount of total sleep time
  - If you sleep > 1 hour during your days off then you are partially sleep deprived
- Napping before or during the shift
- Avoid alcohol, drugs, tobacco
  - **Keep sleep environment dark, quiet and cool**
  - **Timed light exposure with/without diurnal dark goggles**
    - 2350 – 12000 Lux
    - Might exacerbate diurnal insomnia

Pharmacological Management

- Melatonin (weak effect, effects voided by light, quality standard problems)
- **Short acting hypnotics**
  - Helpful in prolonging total sleep time in those with diurnal insomnia
  - Indications, contraindications, interactions, potential benefits & adverse effects
- **Stimulants**
  - Modafinil (FDA approved)
  - Armodafinil (FDA approved)
  - Caffeine - with caution during the second half of the shift

Modafinil in SWD

- Shift workers are very sleepy
- Modafinil improvement of sleepiness was statistically significant
  - Was this improvement **clinically** significant?
    - Mean SOL improved from 2.1 minutes at baseline to 3.8 minutes with MSLT

  - Czeisler et al. NEJM. 2005

Armodafinil was Not Much Better

- MSL mean SOL improved
  - 2.3 (1.4) minutes at baseline
  - 5.3 (5.0) with armodafinil
  - Is this clinically significant?


Summary

- Chronic sleep deprivation and working off “normal” circadian times are impairing
- Obtaining as close as possible to 8 hours of sleep in a 24 hour period
  - One single block or supplementing with a nap before work
  - Avoid drugs, alcohol, tobacco
  - Keep sleep environment dark, quiet and cool
  - Short acting hypnotics may be helpful if diurnal insomnia is present
  - Stimulants with caution. They do not replace insufficient sleep time
  - Routine is the best friend of your sleep
An Update on Home Sleep Testing
ALEXANDER VILLAREAL, MD
MEDICAL DIRECTOR OF THE SLEEP WELLNESS INSTITUTE

What is polysomnography and how is it classified?

Polysomnography
- Simultaneous recordings of multiple physiologic signals during sleep, including:
  - Electroencephalogram (central, occipital, frontal)
  - Electrooculogram (right, left)
  - Electromyogram (chin, tibialis)
  - Electrocardiogram
  - Snoring microphone
  - Nasal/Oral Airflow (thermistor, pressure)
  - Thoracic Effort
  - Abdominal Effort
  - SaO2
  - Body Position / video

Brief History of Polysomnography
1937 – Davis, Loomis, Harvey, Hobart - different stages of sleep were reflected in changes of the EEG
1953 – Asereinsky & Kleitman - Identification of Rapid Eye Movements during Sleep
1957 – Dement & Kleitman - Relationship between eye movements, body mobility, and dreaming
1968 – Rechtschaffen and Kales (R&K) - standard sleep scoring technique
2007 – American Academy of Sleep Medicine - Manual for the Scoring of Sleep and Associated Events

Classification
Type 1 – In sleep center, attended, overnight polysomnogram
Type 2 – Record same variables as type 1, unattended
Type 3 – Evaluate four physiologic parameters – not sleep
  - Respiratory movement and airflow
  - Heart rate
  - Arterial oxygen saturations
  - Inertial (position)
Type 4 – Evaluate one or two parameters (saturation and airflow)

In Lab Polysomnogram (type 1)
Unattended Home Sleep Study (HST) 
Type III

- Abbreviated physiological variables
  - Nasal/Oral Airflow (thermistor, pressure)
  - Thorax/Abdominal Effort
  - SaO2
  - Pulse rate
  - Snoring microphone*
  - Position*

- Rule in moderate to severe OSA with high pre-test probability
- Cannot rule out OSA with a negative test (↓ NPPV)
- Not used for other sleep disorders

Collop. JCSM. 2007

Is Home Sleep Testing a New Concept?

Verification of Sleep Apnea Using a Portable Sleep Apnea Screening Device

Hilelne A. Emsheller, MD, Washington, DC; W. Stuart F. Copass, MD, Minneapolis, Minn; Leland K. Karpawich, MD, Washington, DC; Steven E. Schneck, Ccpp; John H. Mikkelsen; Leonard G. Smith, and Jeffrey N. Moffie, MD, Washington, DC

ABSTRACT: Three women patients referred to a sleep laboratory with a previous diagnosis of obstructive sleep apnea were monitored with a device designed for home use as an apnea screening device. Direct comparison was made between data obtained by the portable device and by data acquired simultaneously with standard polysomnography. We also compared home and nighttime polysomnography and nocturnal oximetry, and blood pressure monitoring. There was no significant difference in the number of obstructive breathing events (apneas and hypopneas) recorded by the two systems. The portable device was found to have a sensitivity of 95% and a specificity of 99%. Limitations and limitations for use of the portable home screening test are reviewed and guidelines for its necessary usage.

Comparisons of Home Sleep Recordings and Polysomnograms in Older Adults with Sleep Disorders

Sonia Anzoli-Izabel, Daniel F. Kripke, William Maussion, and Sam Mover.

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Management of Obstructive Sleep Apnea Syndrome in the Home*

The Role of Portable Sleep Apnea Recording

Michael F. Capuzzi, M.D., F.C.C.P. and Michael Capuzzi, B.S., R.R.T.

Unattended home sleep apnea recording has been shown to be an accurate tool in the diagnosis of moderate to severe obstructive sleep apnea. We studied 12 patients with severe obstructive sleep apnea who had been monitored in our sleep laboratory. The mean AHI was 31 (SD, 12.4). We began nasal continuous positive airway pressure (CPAP) at home and continued with the same CPAP at night. We then divided the level of AHI into three groups: mild (AHI ≤ 15), moderate (AHI 16-30), and severe (AHI > 30). The level of AHI was determined by 1.5 mm systolic blood pressure and the patient's reported episodes of snoring and daytime somnolence. The study was terminated after 6 months. Patients were divided into two groups: those with relief of AHI ≤ 15 and those with relief of AHI 16-30. The study showed that CPAP at home was effective in reducing AHI levels and improving sleep quality.
What is the reimbursement for HST?

ASDA Standards of Practice

Practice Parameters for the Use of Portable Recording in the Assessment of Obstructive Sleep Apnea

Standards of Practice Committee of the American Sleep Disorders Association

Sleep Services National Payment

Why are we using home sleep testing if it is less precise and has lower reimbursement?

http://www.aasmnet.org/resources/pdf/CMSPaymentComparison.pdf

HST in Suspected Simple OSA

- Patient comfort / convenience
- Lower cost for the patient
- High coinsurance payments
- Increasing deductibles
- Patient outcomes appear not to be worsened*
- Good program on appropriate patients
- PAP adherence
- Epworth, QOL
- Mandated by health insurance companies

Why are the Government and Health Insurance Companies Pushing for HST?
High Cost of Health Care Fraud

2011 FBI DATA:
- $1.2 billion in settlements
- $1 billion in fines
- $16 million in seizures
- $30 million in restitution

2012: $16.39 trillion

Since 2001, the estimate of health care fraud has been raised 12 times, for a total of $70.4 billion.
Prevalence of SDB in the General Population is Increasing

- Wisconsin Cohort Group
- General Population
- SDB = OSA + CSA
- AHI > 5/hr
  - Women: 9% SDB; 3% OSA
  - Men: 24% SDB; 7% OSA

Obese Adults – BMI > 30


OSA Worsens with Age

- Young, Arch Intern Med 2002

Obese Adults – BMI > 30

- Young, NEJM 1993
Other Patients at High Risk for OSA

- Obesity (BMI > 35)
- Congestive heart failure
- Atrial fibrillation
- Refractory hypertension
- Diabetes Type 2
- Stroke
- Nocturnal dysrhythmias
- Pulmonary HTN
- High-risk driving populations (CDL)
- Preoperative for bariatric surgery

HST Contraindications

- Severe pulmonary disease
- BMI > 40
- Narcotic analgesic use
- Raynaud’s
- Neuromuscular disease
- Stroke
- CHF
- Inability to cooperate
- Lack of dexterity
- Asymptomatic patients
- Individuals suspected of having other sleep disorders
- Identification of individuals working in safety-critical occupations
- Pediatric populations

Noninferiority of Functional Outcome in Ambulatory Management of Obstructive Sleep Apnea


Does a HST adversely affect OSA outcomes?

Does a HST adversely affect OSA outcomes?
Results & Conclusion

- 296 subjects enrolled
- 260 (88%) diagnosed with OSA
- 213 initiated on CPAP
- Mean FOSQ ± SD improved
  - 1.74 ± 2.81 in the home group (P < 0.001)
  - 1.85 ± 2.46 in the in-laboratory group (P < 0.0001)
- Mean ± SD hours of daily CPAP adherence
  - 3.5 ± 2.5 hours/day in the home group
  - 2.9 ± 2.3 hours/day in the in-laboratory group (P = 0.08)

CONCLUSIONS:
FOSQ & Adherence were not significantly different

What about auto titration positive airway pressure (APAP)?

Other Similar Studies Exist


APAP as Good as a CPAP Titration in Simple OSA

- APAP was equivalent to CPAP in efficacy, adherence, and functional outcomes after 3 or 6 months.
  - Kushida. Sleep. 2011
- APAP was more cost effective and offered similar outcomes among patients with moderate-severe OSA without serious co-morbidities.
  - Voultsi. Thorax. 2010
- Quality, algorithms and reports vary amongst vendors.
- APAP cost is the same or less* than for fixed pressure CPAP

APAP Contraindications

- To diagnose OSA (instead of a PSG)
- Congestive heart failure
- Significant lung disease; (i.e. COPD)
- Obstructive hypoventilation syndrome
- Patients who do not snore (naturally or s/p palate surgery)
- Central sleep apnea syndromes

Morgenthaler. Sleep. 2008
How do I start an out of sleep center testing program?

Deciding if You Can Start an OCST

- Equipment
- Personnel
- Sleep providers
- Patient flow
- Economics
- Other Considerations

Equipment

- Deciding the home testing device to use
  - Simplicity of use, accuracy in leads (SCOPERS Method)
  - Automatic reports versus ability and ease of scoring
  - Number of channels (more leads make it more difficult for the patient)
  - Additional data: position, snore, EEG
  - Cost (upfront, disposables) – Sleep Review Magazine
  - Number of devices needed (what is your estimated volume?)
  - Buying vs. Leasing
  - Compatibility with existing PSG software
  - Previsions in case the patient does not return the equipment

Personnel

- Identify the following people
  - Scheduling
  - Coordinating shipments or HST delivery
  - Patient instruction and education
  - Equipment cleaning / inventory
  - HST Scoring / Interpretation
  - Software / IT
  - Billing
  - Monitoring outcomes (failures, negative studies, turnover time, etc.)
  - Full time vs. part time vs. contracted services

Patient Flow

- Who is allowed to order an HST?
  - Sleep physician, primary care, other specialists
  - Who will first contact / communicate with the patient?
  - Patient education
  - Coordination of delivery and return of equipment
  - Sleep center, home, mail / courier
  - Scoring / Interpretation of studies
  - Patient / health insurance billing
  - Patient follow up and treatment
  - Sleep physician, primary care, other specialists

This model works only with adequate patient evaluation & follow up

9/18/2013
Economics

- Who else is doing HST in your area? (know your competition)
- Primary care groups, specialty groups, dentists, chiropractors, DME
- Are you allowed to provide HST to patients?
- Check contracts with various payors (start with the largest ones)
- Are you excluded in favor of “preferred providers”?
- Getting to be part of an “authorized provider” for 3rd party payors:
  - Obtain application form
  - Track outcomes: number of studies, failed data, turnover time, compliance, ESS, FOSQ, etc.
- What is your expected profit margin? Will it pay the bills?

Partnering with a National Ambulatory Sleep Testing Company

- May represent a reasonable alternative
- Check quality
- Research companies
- Ensure they are contracted with local 3rd party payors
- NovaSom
- Sleep Quest
- National Sleep Services
- Watermark Medical
- Sleep Disorder Services

Durable Medical Equipment

- AASM’s Innovation Care Delivery and Management Program for Patients with OSA
- DME in the Sleep Center to provide integrated care to OSA patients
- Not for patients with Government Insurance
- Meant to minimize transitions of patient care and improve outcomes
- Can add an additional revenue stream to the sleep center
- Plan logistics carefully


What if I wait before changing my practice?

- Go back to use everything

Change is Here to Stay

Sleep HealthCenters closes all 19 locations
What to do with the existing infrastructure?

In Laboratory Polysomnography

Non-Sleep Disordered Breathing
- Parasomnias (RBD)
- Nocturnal Seizures
- Narcolepsy
- Other Parasomnias
- Research

Sleep Disordered Breathing
- Central Sleep Apnea
- Hypoventilation - CO2
- CSA
  - Pediatric
  - Lack of dexterity / behavioral
  - Overlap syndrome (+ COPD)
  - At risk for Complex Sleep Apnea

Final Remarks

Summary – The Ugly
- PSG & APAP will become more prevalent as health insurance companies and government attempt to cut costs.
- Prior authorizations for in laboratory studies will become more onerous and routine.
- Reimbursement for in laboratory polysomnography will drop.
- Sleep centers and people working in them will be affected.

Summary – The Good
- Expect more OSA patients as the population grows older and heavier.
- PSG will open the door to patients who would otherwise not be tested.
- Higher volume of more complex patients (card, neuro, pulm, pain, peds)
- An initial sleep consultation with defensive documentation will ensure the appropriateness of an in lab study.
- Good patient care will be rewarded. (compliance, proper evaluation and follow up)