

수면무호흡 환자 대상 양압기 치료 정복



김 혜 윤

가톨릭관동대 국제성모병원

AGENDA

- Overview of factors involved in CPAP adherence
- Education for PAP treatment
- Proper selection of PAP mask Fitting (Feature and Size)
- CPAP BiPAP titration
- Problem solving



Successful CPAP therapy Journey

Our Goal for PAP treatment

- More effective treatment with PAP**
 - Optimal titration
 - Proper choice of PAP device and mask
- Increased adherence of PAP treatment**
 - Understanding of PAP treatment
 - Sufficient discipline before PAP treatment
 - Personalized management

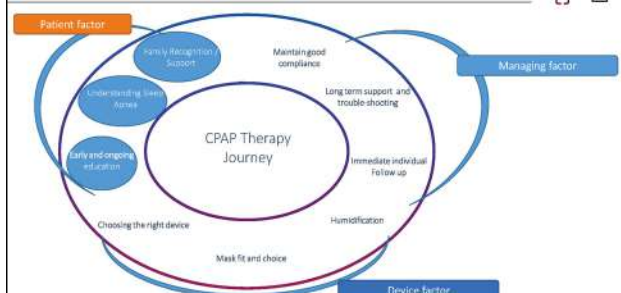
CPAP Therapy Adherence

- How is OSA treatment adherence defined?
 - ≥ 4 hours per night, $\geq 70\%$ of the days monitored or for five out of seven nights (Kribbs¹)
 - normalization of daytime sleepiness, quality of life, and neurocognitive function improvement



1. Kribbs KH, et al. Compliance Measurement in Patients with Sleep-Disordered Breathing with OSA. American Journal of Respiratory Therapy. 1993;107:10-19.
2. Mateika JK, et al. High-Resolution CPAP Use Data for the Treatment of Obstructive Sleep Apnea. Sleep. 2011;34(1):1-11.

CPAP Therapy Journey



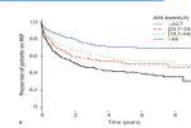
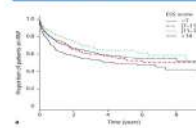
CPAP Adherence Factors



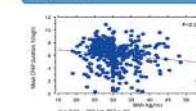
| Greater Adherence | Less Adherence |
|--|---|
| Severe OSA | Mild OSA |
| Resolution of sleepiness, other symptoms | Young and/or single adult |
| Co-morbid illness | High PAP level |
| Early benefit (<7d) | Claustrophobia |
| Comfortable mask | Ill-fitting mask |
| Optimal titration | No/limited patient education |
| Humidifier use | No/limited physician or family support |
| Wife shares the bed | Denial, no 'ownership' of the problem |
| Older patient / female | Lack of understanding |
| Bed partner, physician, staff education/ support | Skin irritation |
| Self-referral | Nasal obstruction |
| Self-management of chronic illness | Persistent symptoms |
| Behavioral readiness to change | Depressive symptoms |
| | Lack of self-efficacy |
| | Dementia, decreased cognition, language barrier |
| | Lack of health insurance |

Non-modifiable factors of CPAP Adherence

Severity of daytime sleepiness and sleep apnea



BMI, Obesity



Front. Neurosci. 02 August 2019

Non-modifiable factors of CPAP Adherence

A Type D personality

- Occurs in 30% of OSA patients
- 50% of "D" personality types are noncompliant
- Negative emotions
- Social inhibition
- Higher incidence of complaints regarding therapy



Non-modifiable factors of CPAP Adherence

Social cognitive therapy for 'A Type D personality'

Two major factors

- First, a person must believe that the **benefits** of performing the behavior outweigh the costs (i.e. a person should have **more positive** than negative outcome expectancies)
- Second, and perhaps most important, the person must have a **sense of personal agency**, or **self-efficacy** with respect to performing the preventive behavior must believe that he or she has the skills and abilities necessary for performing the behavior under a variety of circumstances."

- 수면 무호흡증 치료에 있어서 만족은 치료의 주관적이고 스스로 치료를 받게 나갈 수 있다는 믿음을 갖게 하는 것 (Personal agency)
- 스스로의 행동을 통한 긍정의 경험을 강화시켜 주어, 자기효능감을 높여 시키도록 함.
- 치료를 하지 않았을 때의 결과를 고려할 때, 비유대적 효과를 설명해 줄

Claustrophobia

- A form of specific phobia that entails extreme anxiety and panic elicited by situations in which the individual experiences a sense of being closed in or entrapped.
- Claustrophobia is composed of two "core" fears: fear of restriction, and fear of suffocation.
- Claustrophobia is a common reaction reported in about 15% of all patients.

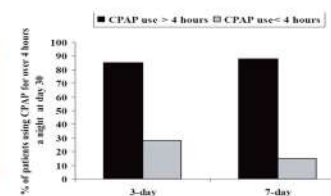


Progressive Mask Desensitization programs have proven successful

First 3 nights are important for PAP adherence

- The early pattern of CPAP adherence is predictive of sustained long-term use
- Emphasis should be placed on **assessing the patient early** after initiating the CPAP therapy (as early as 3 days) and treating or impacting factors that may negatively influence adherence.

Initial Good Adherence
Early Education
Immediate Intervention



Education for PAP treatment

- Do cognitive perceptions influence CPAP use?
 - Yes, Cognitive perceptions influence CPAP use, but only within the context of knowledge of CPAP treatment and treatment use.
- What to educate?

What to educate?

Risk Perception

- Symptoms of OSA
- Functional risk of OSA: Accidents, Memory impairment
- Health risk of OSA: Cardiovascular risk

Treatment outcome expectancies

- Improvement of specific symptoms with CPAP
- Common improvements in daily functioning and quality of life with CPAP

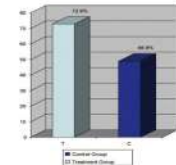
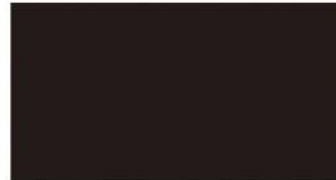
Treatment self efficacy

- Challenges of using CPAP during first several nights of use
- Anticipatory guidance for resolving difficulties with CPAP
- Resources for support and additional clinical assistance with CPAP

Education for PAP treatment

How to educate?

The approximately 15-min videotape depicted two male blue-collar workers discussing their sleep problems, with one describing what sleep apnea was in common language, what CPAP was, what CPAP felt like on a sensory basis, and how it had helped them.



Sleep Medicine 9 (2005) 171-174

Clinical Guidelines for the Manual Titration of Positive Airway Pressure

All potential PAP titration candidates should receive...

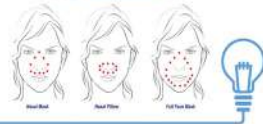
- PAP education
- Hands on demonstration
- Careful mask fitting
- Acclimatization prior to titration



Nasal mask, nasal pillows, full-face/Oronasal mask

Goals

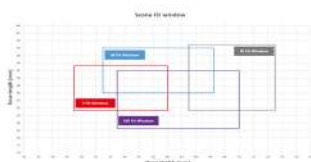
- Maximizing comfort
- Compensating for significant nasal obstruction
- Minimizing leak prior to the PAP titration.



Size of Mask



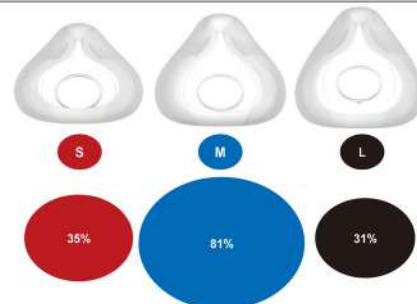
Fit range

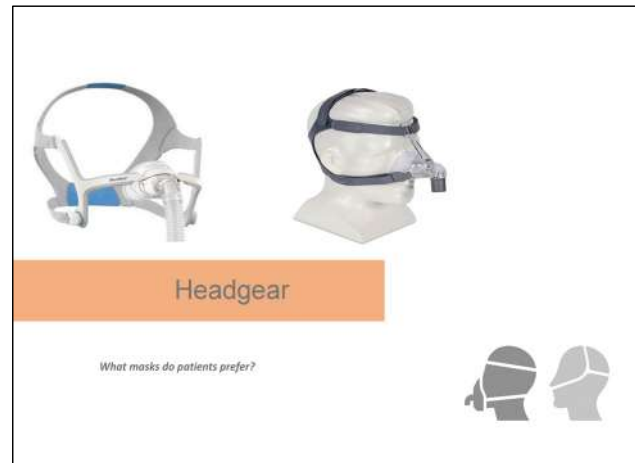
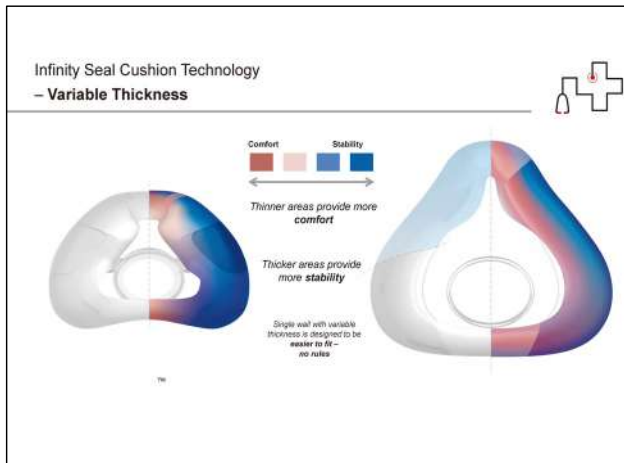


| Expected percentage split for cushion sizes | |
|---|------------|
| Cushion Size | % Coverage |
| S | 45-50% |
| M | 45-50% |
| L | 15% |

| Caucasian | | Hispanic | | African American | | Asian | | Weighted Population | |
|----------------|------------|----------------|------------|------------------|------------|----------------|------------|---------------------|------------|
| Mask Size | % Coverage | Mask Size | % Coverage | Mask Size | % Coverage | Mask Size | % Coverage | Mask Size | % Coverage |
| Optimal Fit: S | 47.28% | Optimal Fit: S | 48.81% | Optimal Fit: S | 48.81% | Optimal Fit: S | 48.81% | Optimal Fit: S | 48.81% |
| Optimal Fit: M | 48.81% | Optimal Fit: M | 48.81% | Optimal Fit: M | 48.81% | Optimal Fit: M | 48.81% | Optimal Fit: M | 48.81% |
| Optimal Fit: L | 48.81% | Optimal Fit: L | 48.81% | Optimal Fit: L | 48.81% | Optimal Fit: L | 48.81% | Optimal Fit: L | 48.81% |

Nasal Mask Size Comparison





Comparison of Two Headgear Systems for Sleep Apnea Treatment of Stroke Patients

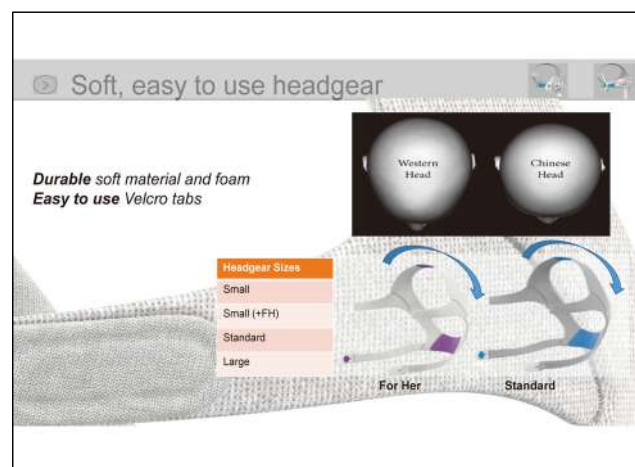
Table 1. Subjective report of ease, comfort and preference of headgear systems: all subjects (n = 30)

| | Definitely head frame | Probably head frame | No preference | Probably straps | Definitely straps |
|--------------------------------|-----------------------|---------------------|---------------|-----------------|-------------------|
| Easiest to put on and take off | 29 (97%) | 1 (3%) | – | 0 (17%) | 12 (40%) |
| More comfortable | 13 (43%) | – | – | 0 (17%) | 9 (27%) |
| Overall preference | 17 (57%) | – | – | 0 (17%) | 9 (27%) |

Table 2. Subjective report of ease, comfort and preference of headgear systems: subjects with disability (n = 22)

| | Definitely head frame | Probably head frame | No preference | Probably straps | Definitely straps |
|--------------------------------|-----------------------|---------------------|---------------|-----------------|-------------------|
| Easiest to put on and take off | 21 (95%) | 1 (5%) | – | 3 (14%) | 9 (41%) |
| More comfortable | 10 (45%) | – | – | 4 (18%) | 9 (41%) |
| Overall preference | 13 (59%) | – | – | 4 (18%) | 9 (41%) |

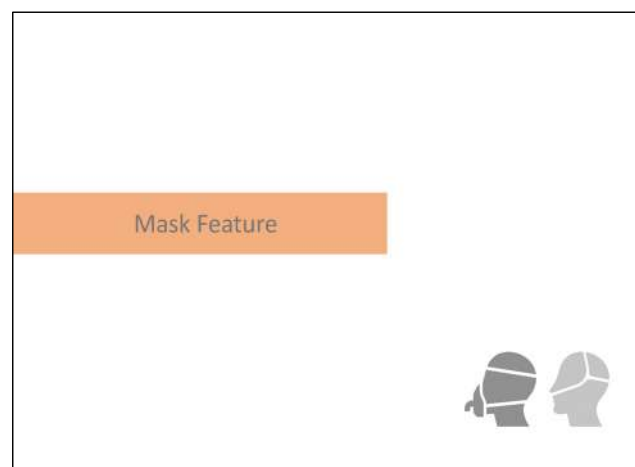
Cochrane DB 2004;22:183-190



Improved leakage

| Therapy | | | | |
|------------------|--------------|-----------------------|---------------|--|
| Pressure - cmH2O | Median: 9.2 | 95th percentile: 10.8 | Maximum: 10.9 | |
| Leaks - L/min | Median: 14.1 | 95th percentile: 34.2 | Maximum: 52.7 | |
| Events per hour | AI: 2.0 | HI: 0.9 | AHI: 2.9 | |
| Apnoea Index | Central: 0.2 | Obstructive: 0.8 | Unknown: 1.1 | |

| Therapy | | | | |
|------------------|--------------|-----------------------|---------------|--|
| Pressure - cmH2O | Median: 9.7 | 95th percentile: 10.9 | Maximum: 10.9 | |
| Leaks - L/min | Median: 7.4 | 95th percentile: 19.8 | Maximum: 31.0 | |
| Events per hour | AI: 1.2 | HI: 0.5 | AHI: 1.7 | |
| Apnoea Index | Central: 0.4 | Obstructive: 0.7 | Unknown: 0.0 | |

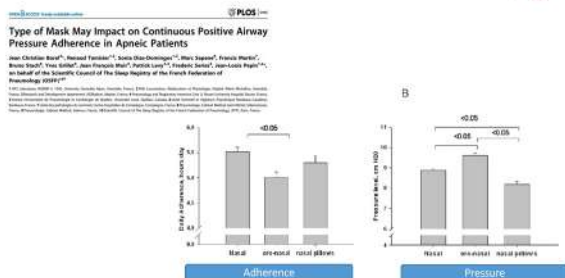


Mask Feature 3 kinds of masks (based on face coverage)

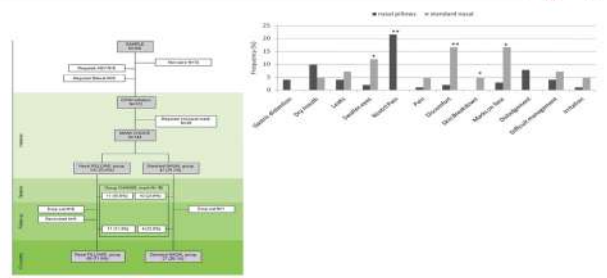


CPAP pressure
depending on Mask type

Mask type and PAP pressure



Nasal pillow vs Nasal



Nasal pillow vs Nasal

The current data suggest that the use of nasal pillows should not be limited to **low-pressure CPAP levels**.

In conclusion, the current data indicate that **nasal pillows could be safely prescribed as first-line interfaces**, as they seem to be efficacious for CPAP titration and long-term treatment, ensuring a good rate of adherence.

Sleep Medicine 41 (2018) 94e99

Nasal Pillow Mask, Pretty simple!

Different style depend on company



CPAP titration

JCSM
Journal of Clinical
Sleep Medicine

SPECIAL ARTICLE

Clinical Guidelines for the Manual Titration of Positive Airway Pressure in Patients with Obstructive Sleep Apnea

Positive Airway Pressure Titration Task Force of the American Academy of Sleep Medicine

Task Force Members: Dale A. Mateika, M.D., Ph.D., RPSCG (Chair); Alexander Chrousos, M.D. (Vice Chair); Richard B. Berry, M.D.; Luc K. Brown, M.D.; David Gozal, M.D.; Conrad Ruck, M.D.; Susan Parthasarathy, M.D.; Stuart F. Quan, M.D.; James A. Rowley, M.D.*

*Stanford University Center of Excellence for Sleep Disorders, Stanford, CA; *Sleep Disorders Center, Mount Sinai Medical Center, Mount Sinai, FL; *Division of Pulmonary, Critical Care, and Sleep Medicine, University of Florida, Gainesville, FL; *University of New Mexico Health Sciences Center, Albuquerque, NM; *Department of Pulmonary, Division of Pediatric Sleep Medicine, University of Louisville, Louisville, KY; *University of Minnesota, Minneapolis, MN; *Yale School of Medicine, New Haven, CT; *Division of Sleep Medicine, Harvard Medical School, Boston, MA; *Department of Internal Medicine, Division of Pulmonary, Allergy, Critical Care & Sleep Medicine, Wayne State University School of Medicine, Detroit, MI

Clinical Guidelines for the Manual Titration of Positive Airway Pressure

All potential PAP titration candidates should receive...

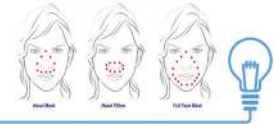
- PAP education
- Hands on demonstration
- Careful mask fitting
- Acclimatization prior to titration



Nasal mask, nasal pillows, full-face/Oronasal mask

Goals

- Maximizing comfort
- Compensating for significant nasal obstruction
- Minimizing leak prior to the PAP titration.



General recommendations



- **Recording the airflow signal generated by the PAP device** or estimating airflow by measurement of the pressure difference between the mask and the outlet of the machine using a **pressure transducer**, with or without Square root transformation of the signal, are acceptable methods for detecting Apneas or Hypopneas (consensus)
- Nasal airflow obtained from a thermistor or thermocouple placed under the PAP mask is **not** an acceptable method for detecting Apneas or Hypopneas (consensus).

Conducting CPAP titration Studies



- CPAP should be increased until the following obstructive respiratory events are eliminated (no specific order) or the recommended maximum CPAP is reached: **apneas, hypopneas, RERAs, and snoring** (consensus).
- The Task Force recommends that **SaO₂ desaturation-resaturation events** occurring without associated obstructive respiratory events should **not** be considered in the decision to increase CPAP in pediatric and adult patients.

Conducting CPAP titration Studies



- The recommended minimum starting CPAP should be **4cm H₂O** in pediatric and adult patients (consensus)
- Methodology to determine CPAP a priori has insufficient evidence, although a higher starting CPAP may be selected for patients with an **elevated body mass index and for retitration studies** (consensus)
- The recommended maximum CPAP should be **15cm H₂O for patients <12 years** and **20cm H₂O for patients ≥12 years** (consensus).

Full Night CPAP titration



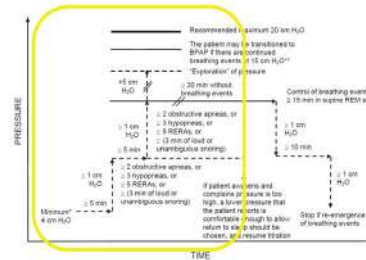
- CPAP should be increased by at least **1cm H₂O** with an interval no shorter than **5min**, with the goal of eliminating obstructive respiratory events (consensus).
- CPAP should be increased if at least **1 obstructive apnea** is observed for patients <12 years or if at least **2 obstructive apneas** are observed for patients ≥12 years (Consensus)
- CPAP should be increased if at least **1 hypopnea** is observed for patients <12 years or if at least **3 hypopneas** are observed for patients ≥12 years (Consensus)

Full Night CPAP titration

- CPAP should be increased if at least 3 RERAs are observed for patients <12 years or if at least 5 RERAs are observed for patients ≥12 years (Consensus).
- CPAP may be increased if at least 1 min of loud or unambiguous snoring is observed for patients <12 years or if at least 3 min of loud or unambiguous snoring are observed for patients ≥12 years (consensus)



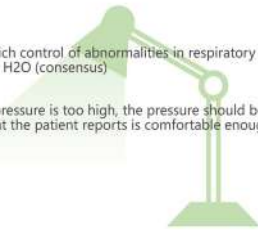
CPAP for >12yr age



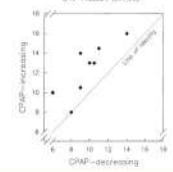
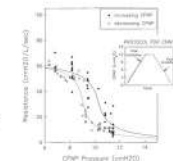
Full Night CPAP titration

"Exploration" of CPAP above the pressure at which control of abnormalities in respiratory parameters is achieved should not exceed 5 cm H2O (consensus)

If the patient awakens and complains that the pressure is too high, the pressure should be restarted at a lower pressure, chosen as one that the patient reports is comfortable enough to allow return to sleep (consensus)



- "Down" titration is not required but may be considered as an option (consensus)
- A "down" titration is recommended due to the "hysteresis" phenomenon during upward titration the PAP level at which flow limitation disappears is 2-5 cm H2O higher than the level at which it reappears during downward titration
- at least one "up-down" CPAP titration (1 cycle) should be conducted during the night.
- It should be conducted when at least 30 min has elapsed without obstructive respiratory events. CPAP should be decreased by more than 1cm H2O with an interval no shorter than 10 min, until there is reemergence of obstructive respiratory events. There is also limited evidence that an "up-down" titration protocol should be considered.



Recommendation: BiPAP (consensus)

- Indications
 - Uncomfortable or intolerant of high CPAP pressure
 - Continued events above 15 cm H2O
- Increase to control apnea, hypopnea, RERA, snoring (no specific order)
- Starting minimum pressure 8/4 (higher for obese or retitration)



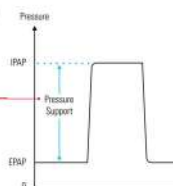
BiLevel Positive Airway Pressure (BiPAP)

- BiPAP has Two pressure settings-

- Inspiratory Positive Airway Pressure (IPAP)
- Expiratory Positive Airway Pressure (EPAP)

- Pressure Support (PS)=IPAP-EPAP
- Max IPAP 20 cm H2O for <12, 30 for ≥12

- Min PS for OSA pt- 4cmH2O
- Max PS for OSA pt- 10cmH2O



Recommendations for BiPAP titration

- If the patient is **uncomfortable or intolerant of high pressures** on CPAP, the patient may be tried on BPAP.
- If there are **continued obstructive respiratory events at 15 cm H₂O** of CPAP during the titration study, the patient may be switched to BPAP (consensus).
- The recommended maximum IPAP should be **20 cm H₂O** for patients <12 years or **30 cm H₂O** for patients ≥12 years (consensus).



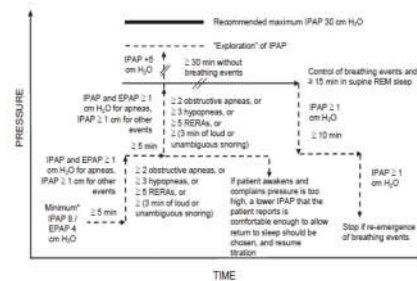
Recommendation: BiPAP

- **Indications for increasing BiPAP**
 - IPAP and/or EPAP at least 1 cm H₂O at intervals of at least 5 min depending on type of respiratory event
 - IPAP and EPAP when at least 1 OA is observed in children, or at least 2 OA are observed in adults
 - IPAP when at least 1 OH is observed in children, or at least 3 OH are observed in adults
 - IPAP when at least 3 RERAs observed in children, or at least 5 RERAs are observed in adults
 - IPAP when at least 1 min snoring in children, or at 3 min snoring observed in adults

Recommendation: BiPAP

- **"Exploration"** of IPAP above the pressure after control of abnormalities in respiratory parameters should not exceed 5 cm H₂O
- If the patient awakens and complains of excessive pressure, the pressure should be restarted at a pressure the patient finds comfortable
- **"Down"** titration may be considered as an option
 - After 30 minutes of control
 - 1 cm H₂O no more than every 10 min until events recur
- Decrease IPAP or change to ST mode should be considered if treatment-emergent central apneas occur

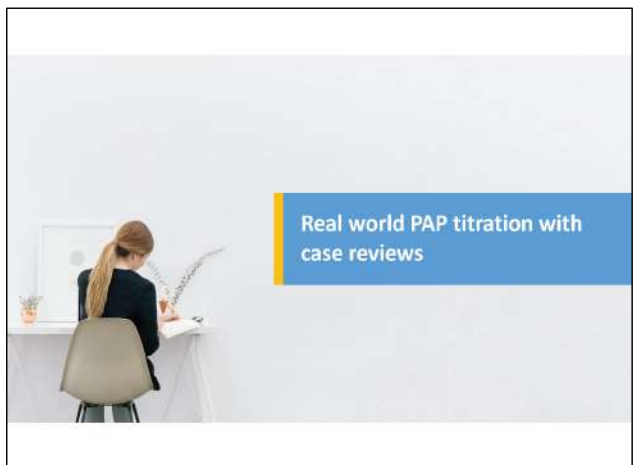
Manual Titration of BiPAP for >12yr age OSA pt

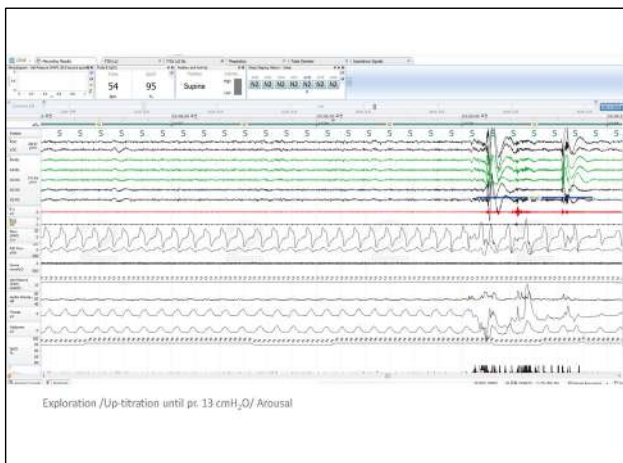
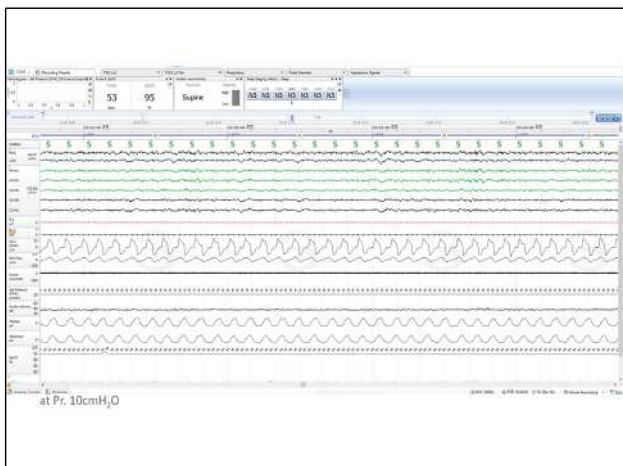
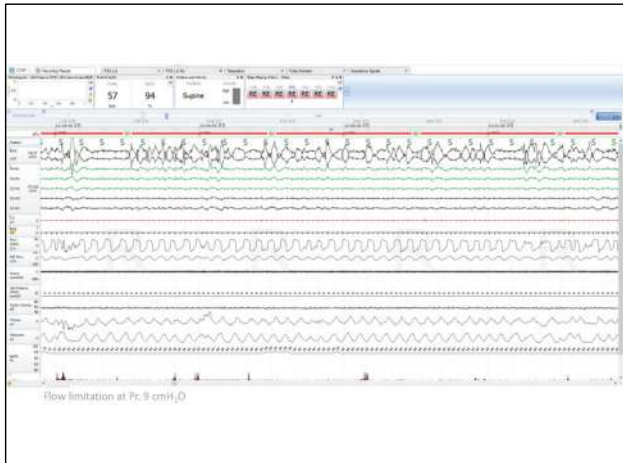


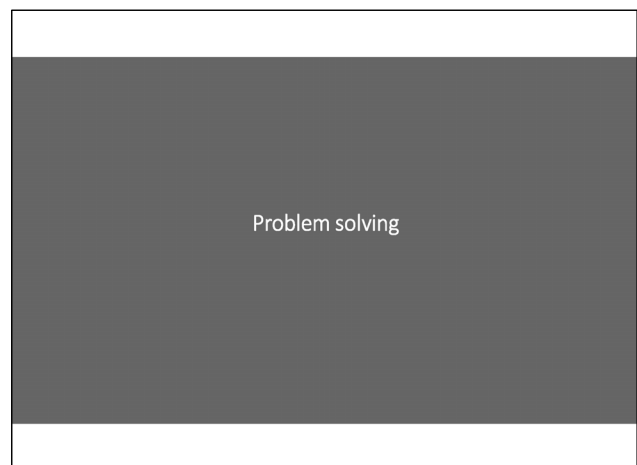
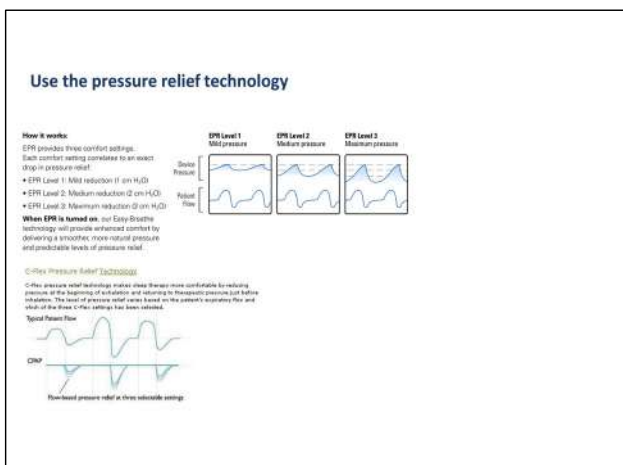
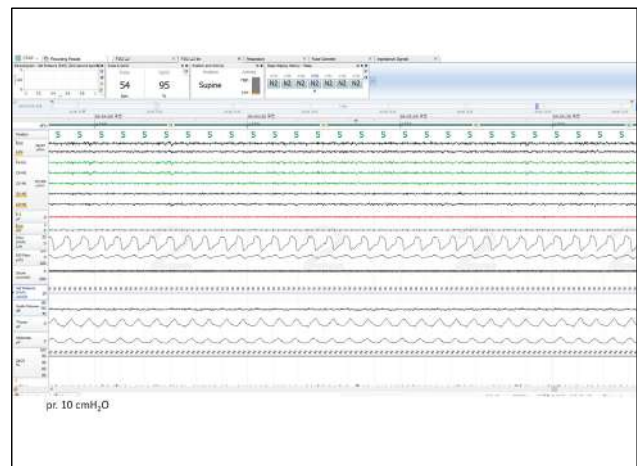
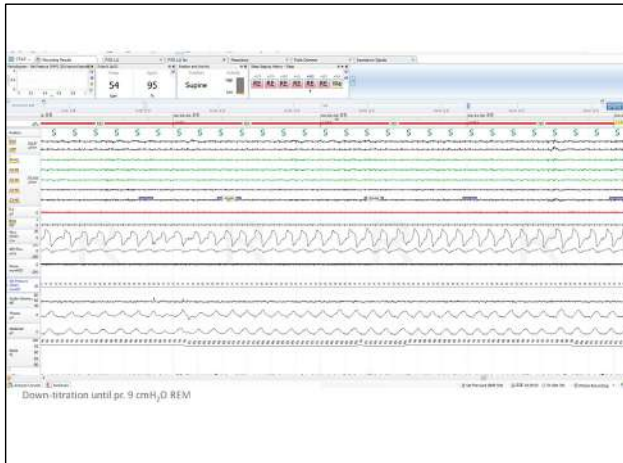
PAP Therapy Outcomes Grading

| Optimal | <ul style="list-style-type: none"> • RDI < 5, for ≥ 15 minutes • Should contain "S" (supine) REM sleep • No continually interrupted by Spontaneous Arousals or awakenings |
|--------------|--|
| Good | <ul style="list-style-type: none"> • RDI ≤ 10 (or reduction 50% when baseline RDI < 15) • Should contain "S" (supine) REM sleep • No continually interrupted by Spontaneous Arousals or awakenings |
| Adequate | <ul style="list-style-type: none"> • RDI > 10 (but reduction ≥75% of baseline RDI) |
| Unacceptable | <ul style="list-style-type: none"> • Does not meet any of the previous discusses grades |

Real world PAP titration with case reviews







Other issues associated with Mask

"입력이 세서 숨을 내릴 수가 없다."
"나를 짓누르는 것 같다."
"기계 소리도 큰데, 마스크에서
배출되는 소리가 거슬린다."
"입력이 너무 높다."
"그냥, 못할 것 같아요!"
"이걸 (마스크) 평생 써야 할까? 나는
몰라요."



Nasal Mask Issue ?? Red Mark on Face



Main headline goes here



Gel Nasal Pad
Gecko™

Bimalar facial rashes why?



ResMed AirFit F20 for Her



COMPLIANCE AIDES



Pillow for patients with CPAP



What is it ?



Summary of Problem solving

| Problem | Possible causes | Possible solutions |
|---|--|--|
| Nasal irritation/ Congestion | Dry air Chronic rhinitis Nasal allergies | Heated humidification Nasal decongestants Nasal steroids Antihistamines |
| Dry throat and/or mouth | Dry air Mouth leak | Heated humidification Chin strap Full face mask |
| Painful pressure in ears | High airway pressure nasal congestion | Verify PAP level Reduction of PAP Nasal decongestants Nasal steroids |
| Gastroic bloating and/or chest discomfort | Air swallowing High airway pressure | Decreased PAP level Titril of automatically titrated or bilevel PAP |
| Discomfortable | Anxiety Mask interface | Desensitization Sensitivities Optimize mask fit |
| Nasal pressure sores | Poor mask fit | Readjust head gear Change mask size or style Apply skin protector |

Summary of Problem solving

| Problem | Possible causes | Possible solutions |
|-----------------|--|--|
| Eye irritation | Mask air leak | Readjust head gear Change mask size or style Reassess patient education on mask fit |
| Skin chafes | Improperly adjusted head gear | Readjust head gear Change mask size or style |
| Skin irritation | Sensitivity to mask interface Improperly adjusted head gear Heat rash | Readjust head gear Lower temperature on humidifier Treat using nasal pillow or skin protector |
| Air leak | Excessive mask/head gear wear Poor mask fit Improperly adjusted head gear Excessive air pressures | Replace mask and/or head gear Change mask/ nasal pillow Readjust head gear Verify pressure setting Consider pressure change Consider auto or bilevel mode |
| | Facial hair interface | Treat with facial pillow Shave Hair wax |