Management of OSA

saurabh maji

INTRODUCTION

Obstructive sleep apnea is a major public health problem

Prevalence of OSAS in INDIA is 2.4% to 4.96% in men and 1% to 2 % in women

In the rest of the world prevalence rate 4% in men and 2% in women

93% of women and 82% of men with moderate severe OSAS are never diagnosed

INOSA GUIDELINE2014

Management

1.POSITIVE AIRWAY PRESSURE DEVICE

2.ORAL APPLIENCES

3.VARIOUS UPPE AIRWAY SURGERY

4.WEIGHT REDUCTION

General measures for treating OSA

Counselling regarding smoking cessation

Avoidance of alcohol, sedatives and nicotine

Treatment of nasal obstruction in consultation with otolaryngologist

Weight reduction

Positional therapy

Sleep hygiene and avoidance of sleep deprivation

INOSA GUIDELINE-2014

Indication of PAP therapy

AHI or RDI ≥15 events/hour

Or

AHI or RDI ≥5 but <15 events/hour with any one of the following symptoms:

- Excessive daytime sleepiness
- Neurocognitive impairment
- Hypertension
- Coronary artery disease
- Cardiac arrhythmias
- Pulmonary hypertension
- History of stroke

Am J RespirCrit Care Med. 2012;186(7):677-683

POSITIVE AIRWAY PRESSURE

Mainstay of treatment of OSA

Patient compliance is a major issue
Counseling is necessary

PAP creates a pneumatic splint in the upper airway which prevents collapse of the pharyngeal airway

PAP therapy improves quality of life
Significant reduction in daytime sleepiness
Driving performance
Neuro-cognitive performance and
Cardiovascular outcomes including overall mortality

Am J RespirCrit Care Med. 2012;186(7):677-683

Description and methodology of manual PAP titration

PAP TITRATION	
AGE BELOW 12 YRS	AGE MORE THAN 12 YEARS
CPAP minimum of 4 cm of water and maximum of 15 cm of water	CPAP minimum of 4 cm of water and maximum of 20cm of water

Increase pressure by one cm of water at an interval of no less than five minutes in following cases-

Patient<12 yr	Patient>12 yr
1 obstructive apnoea	2 obstructive apnoeas
1 hypopnoea	3 hypopnoeas
3 RERAS	5 RERAS
1 min of loud unambigious snoring	3 min of loud unambiguous noring

Titration guideline for when and how to switch to BIPAP

Uncomfortable or is intolerant of high CPAP pressures

When CPAP level is 15 cm H2O and respiratory disturbances continue

Patient has OSA and OHS

Patient with OSA and COPD

Begin BPAP at EPAP 4 cm H2O or the CPAP level at which obstructive apnea was eliminated; set IPAP 4 cm H2O higher

Am J RespirCrit Care Med. 2012;186(7):677-683

PATIENT<12 YRS	Patients >12 yrs
Minimum IPAP 8cm of water, EPAP 4cm of water	Minimum IPAP 8 cm of water , EPAP 4cm of water
Maximum IPAP 20 cm of water	Maximum IPAP 30 cm of water
Minimum I/E difference 4 cm of water	Minimum I/E difference 4 cm of water
Maximum I/E difference 10 cm of water	Maximum I/E difference of 10 cm of water

AASM clinical guideline for manual titration of PAP in OSA patients –update 2012

Increase both IPAP and EPAP pressures by a minimum of 1 cm H2O with an interval of no less than 5 minutes when the following occur

Patient age<12 yrs	Patient age >12 yrs
One obstructive apnoea	Two obstructive apnoeas

Increase IPAP pressure by a minimum of 1 cm H2O with an interval of no less than 5 minutes when the following occurs

<12 years	>12 years
One hypopnoea	Three hypopnoeas
Three RERAS	Five RERAS
One min of loud or unambiguous snoring	Three min of loud or unambigious snoring

DETERMINING THE OPTIMUM PRESSURE

The patient must be able to sleep in order for PAP titration to be successful. If the patient awakens and complains the pressure is too high, the pressure should be reduced to a level at which the patient is able to return to sleep

Mask and mouth leaks should be promptly addressed

Pressure relief technologies may be implemented to improve patient comfort

BPAP may be utilized for patients who are intolerant of high CPAP pressures

Supplemental Oxygen

when awake supine SpO2 on room air is less than 88% for 5 minutes or longer

Supplemental O2 may also be added during the PAP titration when SpO2 is ≤88% for ≥5 minutes in the absence of obstructive respiratory events

Supplemental oxygen should be introduced into the PAP device at the device tubing connection using a T connector, not at the PAP mask

The recommended minimum starting rate for adult and pediatric patients is 1 L/min

Titrate O2 in 1 L/min increments with an interval of no less than 15 minutes until SpO2 is between 88% and 94%

TYPE OF TITRATION ACHIEVED

1.OPTIMAL

2.GOOD

3.ACCEPTABLE

4.UNACCEPTABLE

Optimal titration

The Respiratory Disturbance Index (RDI) is < 5 per hour for a period of at least 15 minutes at the selected pressure and within the manufacturer's acceptable leak limit

The SpO2 is above 90% at the selected pressure

Supine REM sleep at the selected pressure is not continually interrupted by spontaneous arousals or awakenings

GOOD TITRATION

The Respiratory Disturbance Index (RDI) is < 10 per hour (or is reduced by 50% if the baseline RDI was <15) for a period of at least 15 minutes

The SpO2 is above 90% at the selected pressure

Supine REM sleep at the selected pressure is not continually interrupted by spontaneous arousals or awakenings

ADEQUATE TITRATION

Which does not reduces overnight RDI<10 per hour but reduces RDI>75% of baseline in severe OSA patients

or

in which titration grading criteria of optimal or good titration are achieved with exception that supine REM does not occur at selected pressure

AUTO PAP

Continuously adjusting positive airway pressure to meet the patient's variable needs to maintain a patent airway

Reducing the overall mean airway pressure

Unattended setting such as the patient’s home

Enhances tolerability and compliance

Purpose of APAP devices

Replacement of in-laboratory manual titration

Reducing mean airway pressures for achieving better compliance with PAP

Adapting PAP levels to changes in severity of OSA in response to changes in sleep state, weight and body position

Cochrane Database Syst Rev. 2009;(4)

AUTO PAP

APAP when used in level 3 and 4 to diagnose OSA, has been shown to achieve benefits comparable to CPAP levels derived from in-lab attended polysomnography

INOSA GUIDELINE2014

Should not be used with significant co-morbidity that lead to hypoventilation, such as morbid obesity, COPD and CHF

Am J RespirCrit Care Med. 2012;186(7):677-683

Ip et al. Systematic Reviews 2012, 1:20
http://www.systematicreviewsjournal.com/content/1/1/20

SYSTEMATIC REVIEWS

RESEARCH Open Access

Auto-titrating versus fixed continuous positive airway pressure for the treatment of obstructive sleep apnea: a systematic review with meta-analyses

Stanley Ip[1], Carolyn D'Ambrosio[1,2], Kamal Patel[1], Ndidiamaka Obadan[1], Georgios D Kitsios[1], Mei Chung[1] and Ethan M Balk[1*]

REGARDING COMPLIENCE

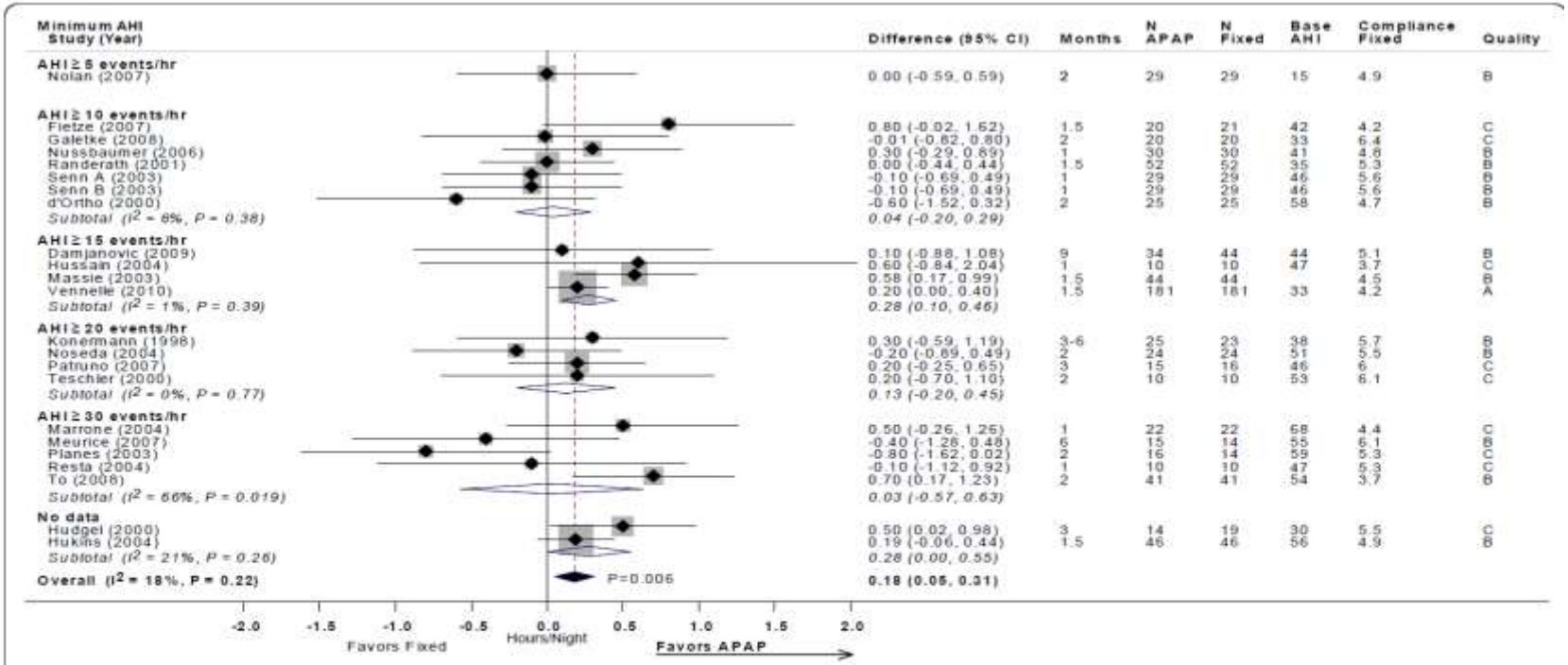


Figure 2 CPAP compliance (hour/night) with APAP versus fixed CPAP: meta-analysis, with subgroup analyses by minimum AHI threshold. Estimates and 95% CIs by study subgrouped by minimum AHI threshold used in each study. The overall random effects model meta-analysis is displayed by the black diamond, which spans the width of the 95% CI. Each subgroup meta-analysis, by AHI threshold, is shown by the open diamonds. Grey boxes are proportional to the weight of each study in the overall meta-analysis. For each meta-analysis the I^2 statistic and the *P* value for heterogeneity is displayed. The *P* value for the summary estimate is displayed next to the black diamond. Note that studies favoring APAP are to the right of the vertical 0 line. Base AHI: baseline apnea-hypopnea index (events/hour) in fixed CPAP group; compliance fixed: compliance (hour/night) in fixed CPAP group; fixed: fixed CPAP.

AHI

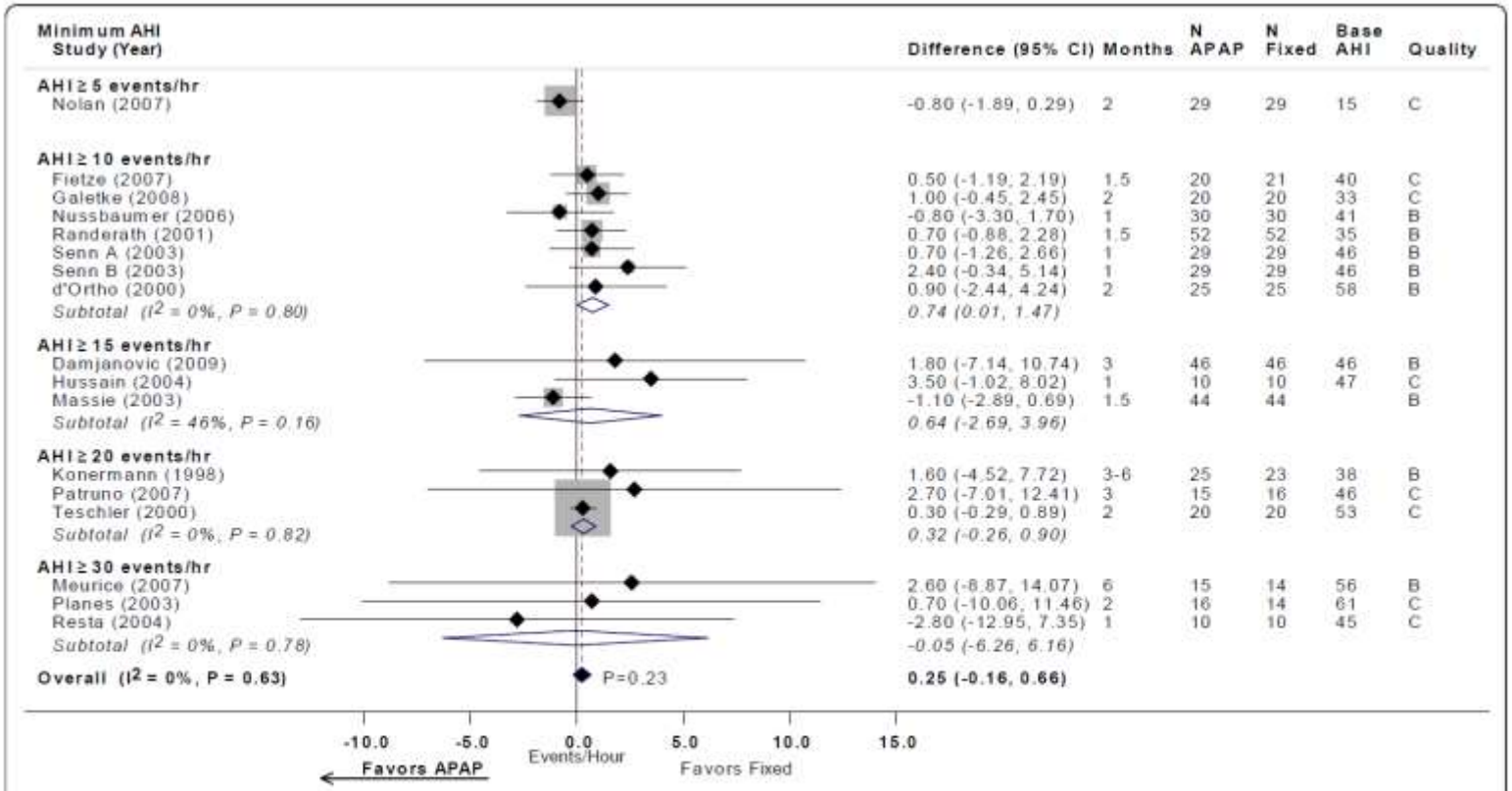


Figure 3 AHI (events/hour) with APAP versus fixed CPAP: meta-analysis, with subgroup analyses by minimum AHI threshold. See Figure 2 legend. Note that studies favoring APAP are to the left of the vertical 0 line. Senn A and Senn B were comparisons of two different APAP devices versus fixed CPAP reported in the same study. Base AHI: baseline apnea-hypopnea index (events/hour) in fixed CPAP group; fixed: fixed CPAP.

DAYTIME SLEEPINESS

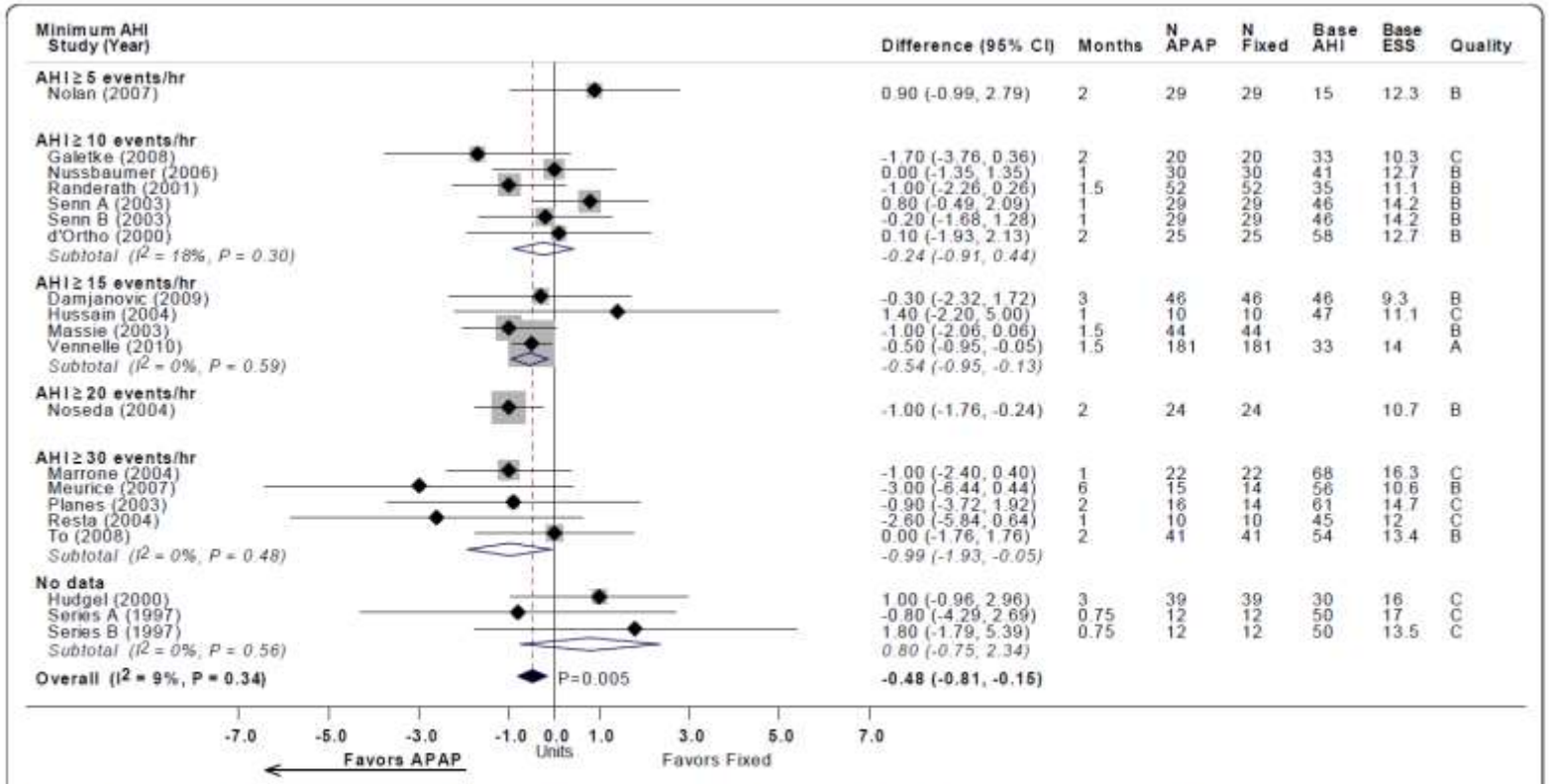


Figure 4 ESS with APAP versus fixed CPAP: meta-analysis, with subgroup analyses by minimum AHI threshold. See Figure 2 legend. Note that studies favoring APAP are to the left of the vertical 0 line. Senn A and Senn B, and Sériès A and Sériès B, were comparisons of two different APAP devices versus fixed CPAP reported in the same study, respectively. Base AHI: baseline apnea-hypopnea index (events/hour) in fixed CPAP group; base ESS: baseline Epworth Sleepiness Scale (no units) in fixed CPAP group; fixed: fixed CPAP.

MINIMUM OXYGEN SATURATION

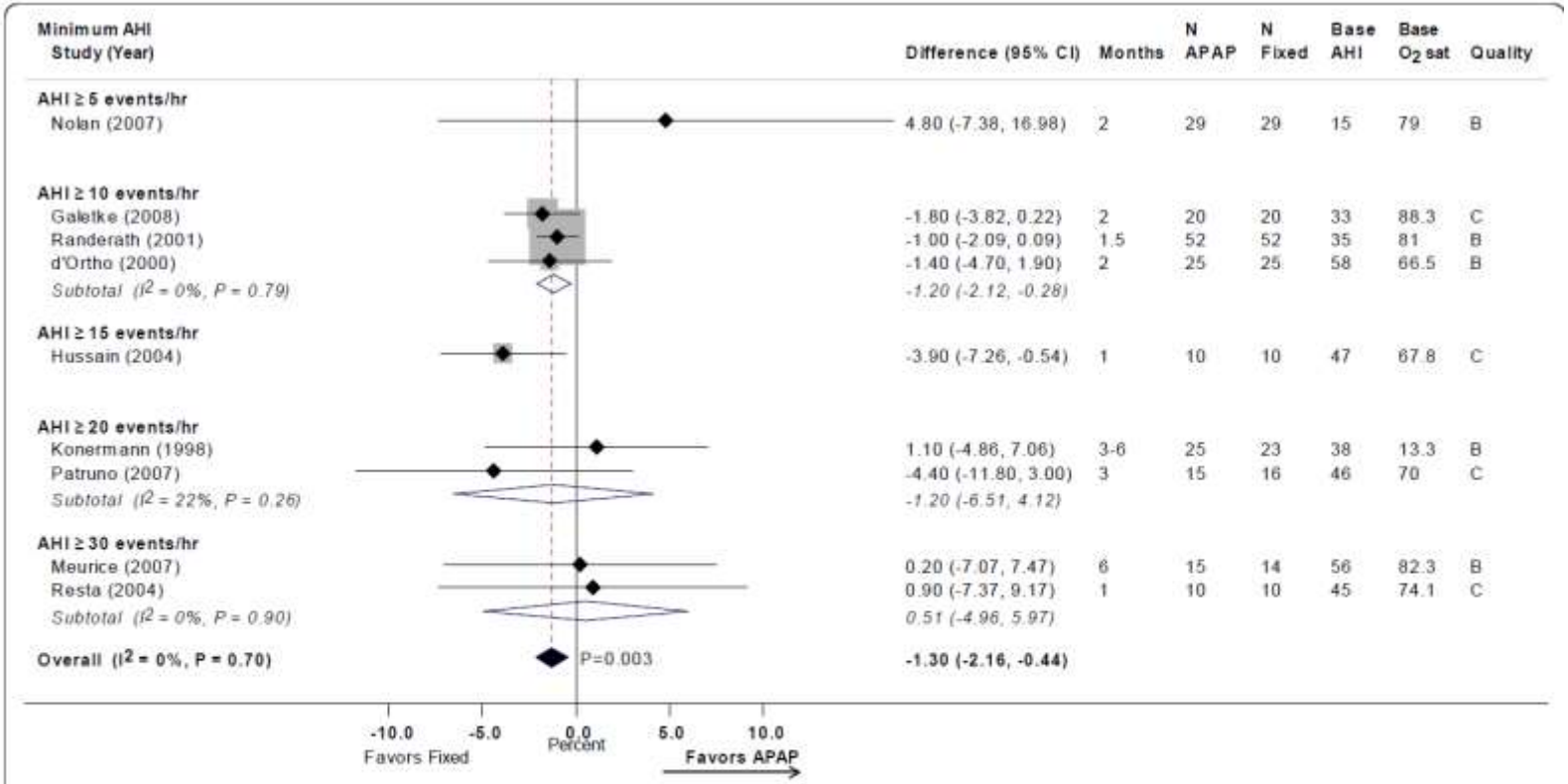


Figure 6 Minimum oxygen saturation (%) with APAP versus fixed CPAP: meta-analysis, with subgroup analyses by minimum AHI threshold. See Figure 2 legend. Note that studies favoring APAP are to the left of the vertical 0 line. Senn A and Senn B were comparisons of two different APAP devices versus fixed CPAP reported in the same study. Base AHI: baseline apnea-hypopnea index (events/hour) in fixed CPAP group; Base min O2: baseline minimum oxygen saturation (%) in fixed CPAP group; fixed: fixed CPAP.

APAP improved compliance by 11 minutes per night

Day time sleepiness as measured by the Epworth Sleepiness Scale improved by 0.5 points in APAP arm

Fixed CPAP improved minimum oxygen saturation by 1.3% more than APAP

Therapy of choice should depend on other factors such as patient preference, specific reasons for non-compliance and cost

PAP PRESCRIPTION

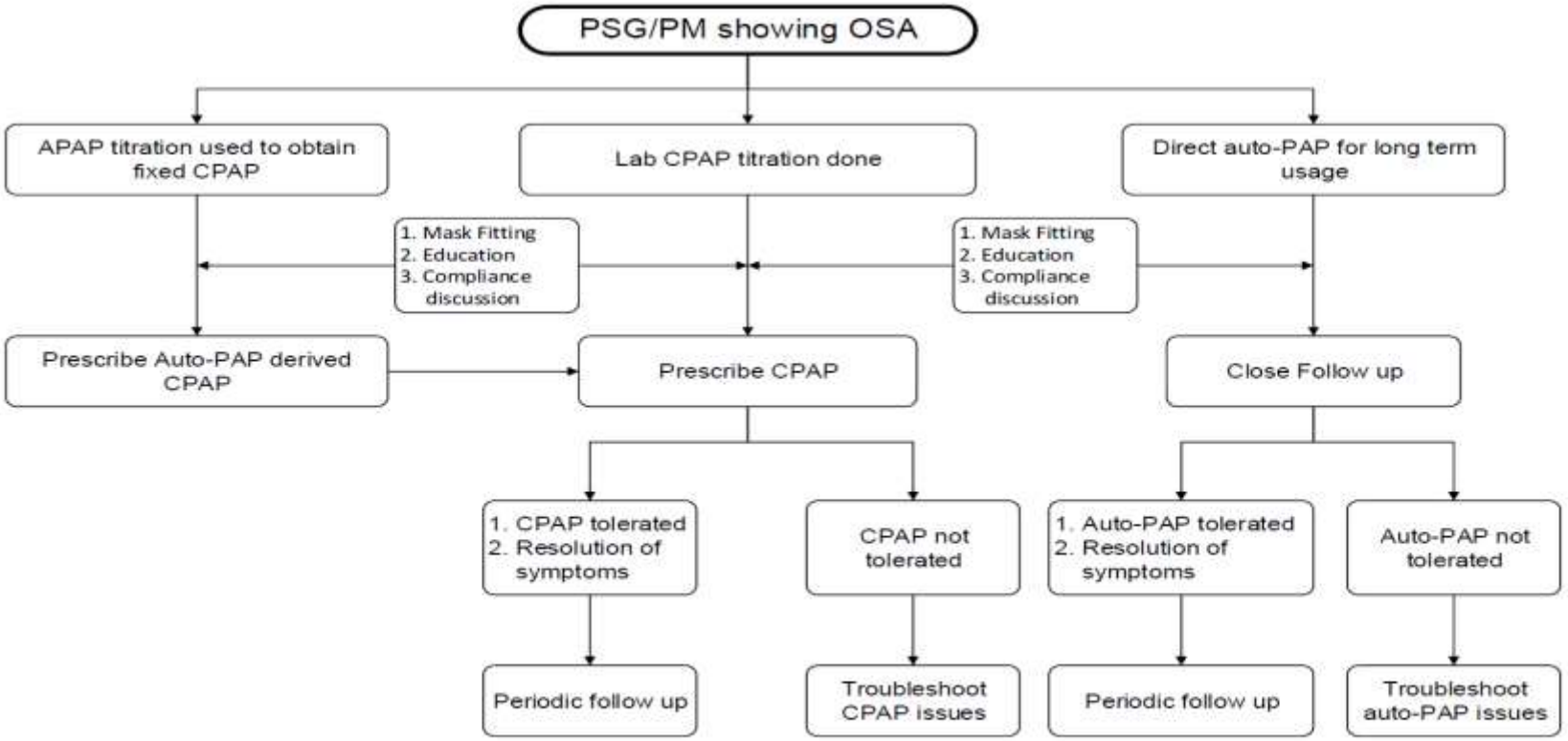


Figure 5-1: Comprehensive Approach to PAP Prescription

FOLLOW UP

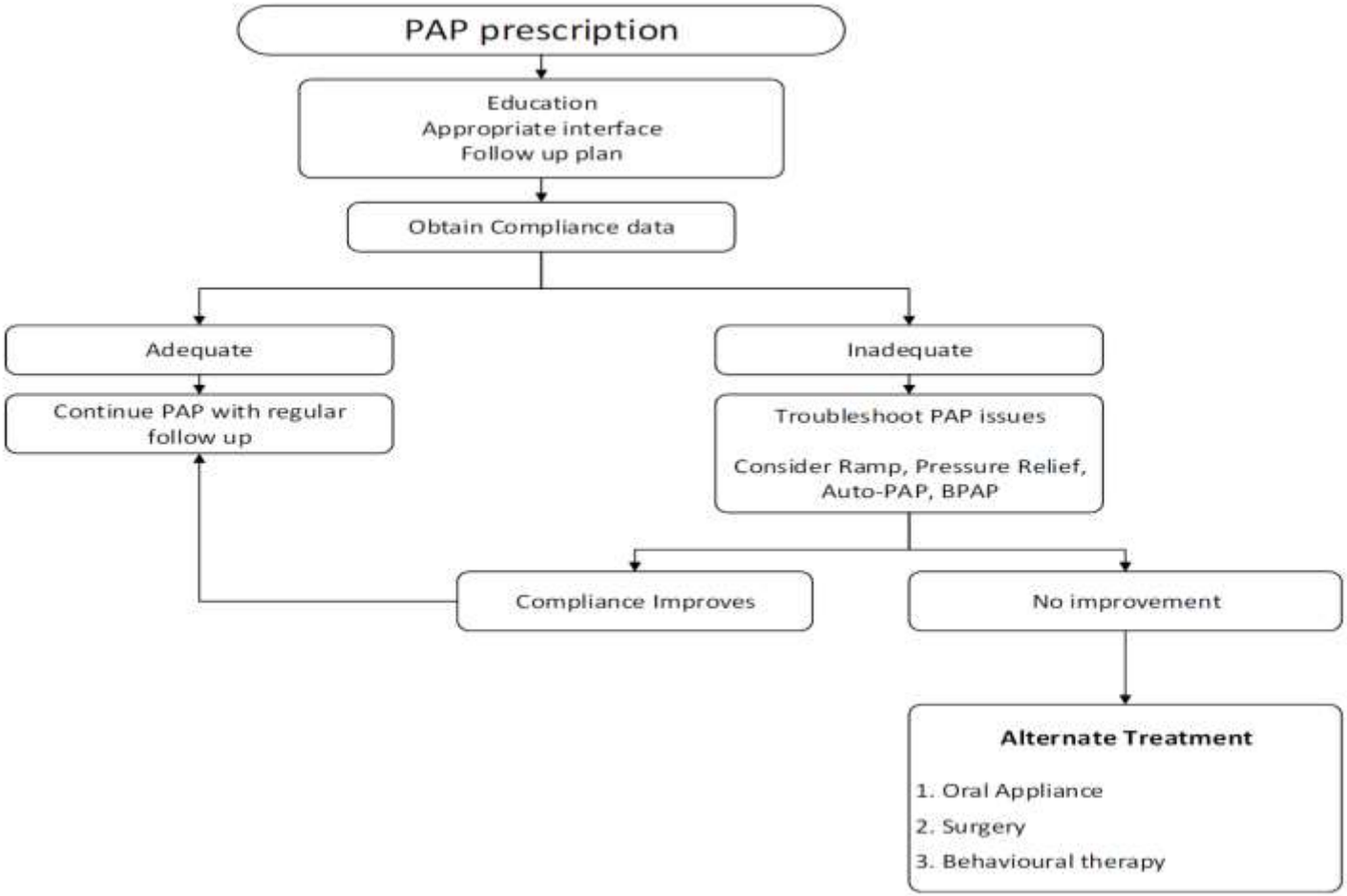


Figure 5-2: Suggested follow-up after PAP prescription.

Oral appliences

OAs by maintaining the patency of the posterior pharynx

Fit by a qualified dentist

Maintain pharyngeal patency by advancing the mandible forward (mandibular repositioning appliances) or maintaining the tongue in an anterior position (tongue-retaining devices) or both

Chang AS Thorax 2010;65:726–732.

Oral appliences

Indicated for patients with mild to moderate OSA and for patients with severe OSA who are intolerant or choose not to use CPAP therapy

More recent data demonstrate that a trial of this approach to therapy may also be reasonable for patients with more severe disease (AHI >30 events per hour)

Thorpy M Sleep 2012;18:511-513
INOSA GUIDELINE 2014

Oral appliances for obstructive sleep apnoea (Review)

Lim J, Lasserson TJ, Fleetham J, Wright JJ

Analysis 1.3. Comparison 1 Active oral appliance versus control appliance, Outcome 3 Apnoea Hypopnea Index - first arm/parallel studies.

Review: Oral appliances for obstructive sleep apnoea

Comparison: 1 Active oral appliance versus control appliance

Outcome: 3 Apnoea Hypopnea Index - first arm/parallel studies

Study or subgroup	Active appliance N	Mean(SD)	Control appliance N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Blanco 2005	8	9.6 (12.1)	7	11.7 (7.9)		21.6 %	-2.10 [-12.33, 8.13]
Gotsopoulos 2002	36	13.54 (12.95)	37	24.22 (14.12)		58.5 %	-10.68 [-16.89, -4.47]
Hans 1997	12	21.1 (21.4)	12	46.8 (46.9)		2.7 %	-25.70 [-54.87, 3.47]
Johnston 2002	12	18.04 (18.08)	8	40.9 (21.21)		7.0 %	-22.86 [-40.77, -4.95]
Mehta 2001	12	11.65 (9.38)	12	29.11 (24.46)		10.3 %	-17.46 [-32.28, -2.64]
Total (95% CI)	**80**		**76**			**100.0 %**	**-10.78 [-15.53, -6.03]**

Heterogeneity: Chi^2 = 6.30, df = 4 (P = 0.18); I^2 =37%

Test for overall effect: Z = 4.45 (P < 0.00001)

Test for subgroup differences: Not applicable

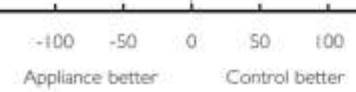


Figure 2. Forest plot of comparison: 1 Active oral appliance versus control appliance, outcome: 1.1 Epworth sleepiness score - first arm data/parallel studies.

	Active appliance			Control appliance				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Blanco 2005	5.1	1.9	8	13.6	6.7	7	11.2%	-8.50 [-13.63, -3.37]	
Gotsopoulos 2002	7.81	4.78	36	8.51	4.72	37	62.2%	-0.70 [-2.88, 1.48]	
Hans 1997	8.2	4	12	12.5	5.7	12	19.0%	-4.30 [-8.24, -0.36]	
Johnston 2002	13	6.91	11	11.43	6.35	7	7.6%	1.57 [-4.66, 7.80]	
Total (95% CI)			**67**			**63**	**100.0%**	**-2.09 [-3.80, -0.37]**	

Heterogeneity: Chi² = 10.08, df = 3 (P = 0.02); I² = 70%

Test for overall effect: Z = 2.38 (P = 0.02)

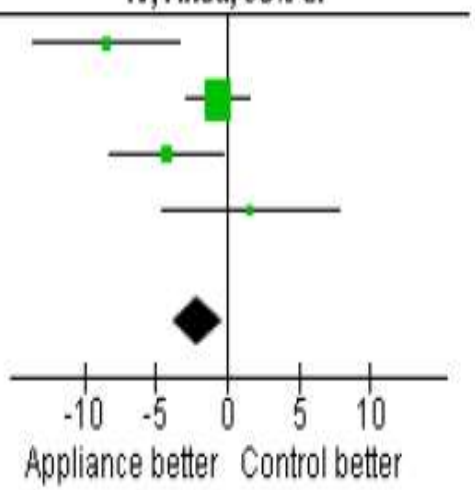
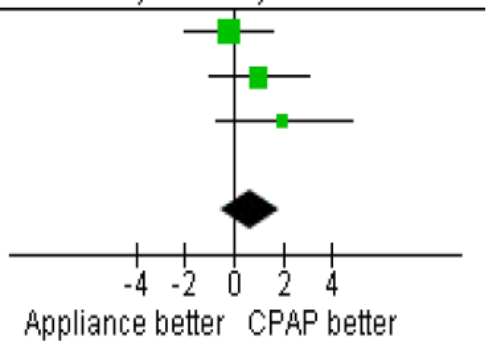


Figure 4. Forest plot of comparison: 2 Oral appliance versus continuous positive airways pressure, outcome: 2.1 Epworth sleepiness scale - first arm data/parallel studies.

	Oral appliance			CPAP				Mean Difference	Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**IV, Random, 95% CI**
Fleetham 1998	9.3	4.7	50	9.5	4.5	51	45.5%	-0.20 [-2.00, 1.60]	
Hoekema 2006	6.9	5.5	49	5.9	4.8	50	35.4%	1.00 [-1.04, 3.04]	
Lam 2007	9	5.83	34	7	5.83	34	19.1%	2.00 [-0.77, 4.77]	
Total (95% CI)			**133**			**135**	**100.0%**	**0.64 [-0.57, 1.86]**	

Heterogeneity: Tau² = 0.00; Chi² = 1.89, df = 2 (P = 0.39); I² = 0%

Test for overall effect: Z = 1.04 (P = 0.30)



Oral appliences

CPAP is more effective at resolving OSA events and improving oxygen saturations, although oral appliances tend to improve symptoms of daytime sleepiness to a similar degree as CPAP

The impact of oral appliance therapy on hypertension, other cardiovascular outcomes, and mortality is not clear

Kushida CA Sleep 2012;29:240–243

Limiting factors

Cost

Difficulty in predicting success

Tolerability prior to initiating therapy

Inability to monitor compliance with treatment

Predictor of sucess

Female sex

Younger age

Lower BMI

Smaller Neck circumference

Cephalometric parameters:

- Short palate
- Large retro-palatal airway space
- Narrow anterior posterior position of mandible
- Higher anterior posterior position of the maxilla

INOSA GUIDELINE2014

TYPES

MANDIBULAR REPOSIONING APPLIENCE(MRA)

Bringing the mandible forward, so increasing the airway volume

Fixed (pre-determined advancement)

Titratable (adjustable) allows progressive advancement of the mandible after initial construction until the optimal mandibular position is achieved

TONGUE RETAINING POSITION

Large tongue

When use of MRA is limited due to edentulous ridge

Contraindication to OA therapy

Inadequate number of healthy teeth in upper and lower dental arch (At least 6-10 teeth in each arch desirable)

Periodontal diseases

Patients with full artificial dentures

Limitation in forward protrusion of mandible and jaw opening

Temporo-mandibular joint diseases

Oral Maxillofac Surg Clin North Am, 2009;21(4):413-420

Adverse effect of OAS

Excessive salivation

Temporary discomfort after awakening

Mucosal dryness

Transient discomfort in teeth, gum and TMJ Headache

Distal migration of upper dentition

Eur J Orthod 2011; 33(3):318–324

COMPLIENCE WITH OA

Depends on benefits and discomfort

Ranges from 51% to 88%. Among the various types of oral appliances

MAD has more compliance than any other appliance

Eur J Orthod 2011; 33(3):318–324

conclusion

Appropriate for use in patients having primary snoring

Patients with mild to moderate OSA
who prefer oral appliances to CPAP, or
who do not respond to CPAP

In severe OSA, initial trial with PAP should be given before treating with OAs

Sleep Breath2012;16:47–58.

Nasal expiratory positive airway pressure

Potential treatment alternative to PAP therapy for OSA

Increasing upper airway patency by creating expiratory positive airway pressure (EPAP)

Greatest benefit was observed in those with mild disease

Berry RB Sleep 2011;34:479-85

MECHANISM OF nEPAP

Increased the functional residual capacity

Produce tracheal traction

Reducing upper airway collapsability

Passive dialation of upper airway by producing expiratiry pressure carrying over into inspiration

Berry RB Sleep 2011;34:479-85

Oral negative pressure therapy

Alternative to applying positive pressure to maintain the patency of the upper airway

This device generates negative oral pressure by drawing the tongue and soft palate in more anterior positions via a mouthpiece connected to a suction mechanism

Upper airway muscle stimulation therapy

Stimulation of hypoglossal nerve improved upper airway patency via stimulation of the genioglossus muscle, resulting in protrusion of the tongue

several companies have developed hypoglossal nerve stimulation (HGNS) device

This device has a neurostimulator that is implanted under the skin in the upper chest (similar to a cardiac pacemaker)

INOSA GUIDELINE2014

Upper airway muscle stimulation therapy

A stimulation electrode placed on the hypoglossal nerve

Sensing lead that is placed between the internal and external intercostal muscles to detect ventilatory effort

The device is activated prior to bedtime and deactivated in the morning after awakening

Bariatric surgery

Surgical weight loss via various bariatric procedures has been associated with even greater reductions in weight as well as improvements in OSA

Dose-dependent improvements in OSA for a given amount of weight loss

Most patients, regardless of the method of surgical weight loss, have residual OSA despite significant reductions in weight

JAMA. 2004. 13;292(14):1724-37

Effects of Surgical Weight Loss on Measures of Obstructive Sleep Apnea: A Meta-Analysis

David L. Greenburg, MD, MPH,[a,b] Christopher J. Lettieri, MD,[c] Arn H. Eliasson, MD[c]

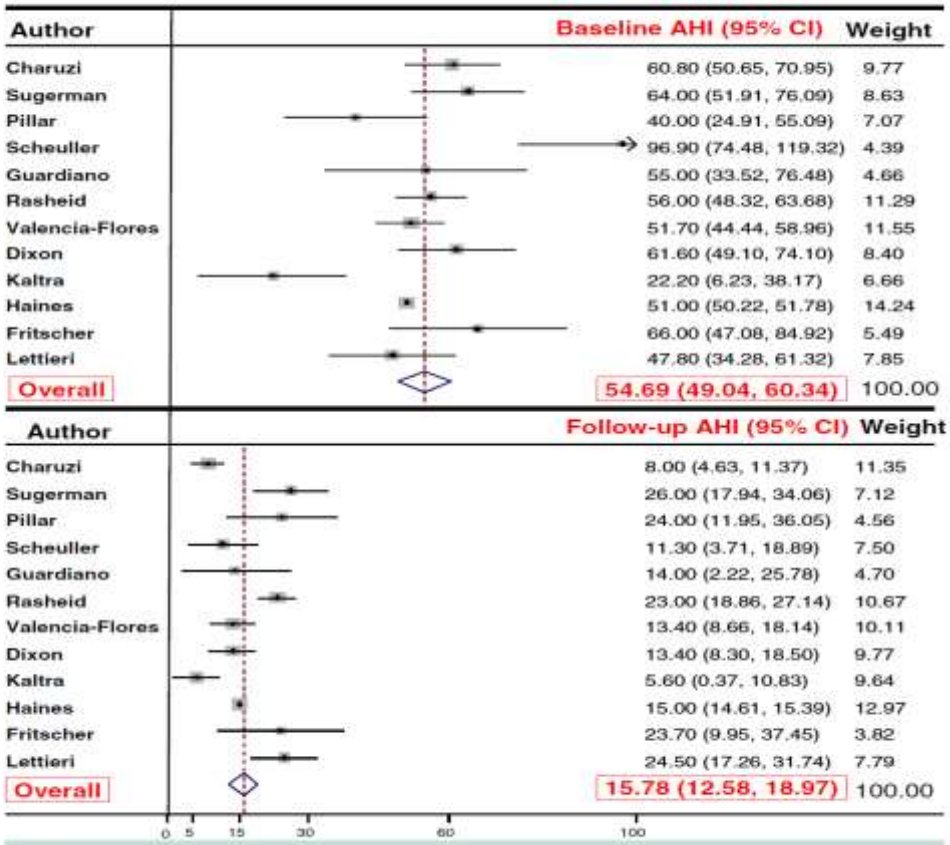


Figure 2 AHI at baseline and after bariatric surgery. AHI = apnea-hypopnea index; CI = confidence interval.

Bariatric surgery

Many patients may be left with significant residual OSA requiring other treatments

Weight loss via diet or bariatric procedures should not be considered a primary therapy for OSA across the spectrum of disease severity and should be recommended as a secondary therapy or intervention that supplements a primary treatment such as CPAP or oral appliances

Am J Med. 2012;122(6):535-42

Nasal and Nasopharyngeal Surgery

Not a useful method of treatment of moderate to severe sleep apnea

It improves the compliance with PAP and also improves its effectiveness

Am J Rhinol Allergy. 2011 Jan-Feb;25(1):45-9

Uvulopalatopharyngoplasty (UPPP)

Patients with retropalatal obstruction

A significant difference in favour of LUP was reported in terms of apnoea hypopnoea index (AHI) and frequency and intensity of snoring

De Luca S.Evid Based Med. 2006 Aug; 11(4):106.

UPPP versus oral appliance: AHI was significantly lower with OA therapy than with UPPP. No significant differences were observed in quality of life

Cochrane Database Syst Rev. 2005 Oct 19;(4)