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TRATAMIENTO DE LA APNEA MEDIANTE PRÓTESIS ORAL. ACTUALIZACIÓN Y RESULTADOS.

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Resumen:

El síndrome de apnea-hipopneas del sueño (SAHS), se caracterizó por episodios recurrentes de obstrucción parcial (hipopnea) o total (apnea) de las vías aéreas superiores (VAS). Esto provocó un colapso de la VAS con niveles de oxihemoglobina reducidos y microdespertares con sueño no satisfactorio, somnolencia diurna excesiva, trastorno respiratorios y cardíacos.

Para intentar solucionar el SAHS teníamos diferentes tipologías de tratamientos, como los dispositivos de avance mandibular (MAD), que fueron los más empleado en los pacientes que no toleraban el tratamiento con CPAP (continuous positive airway pressure). Estos aparatos favorecían el avance mandibular, estabilizaban y recolocaban la mandíbula y el hueso hioides impidiendo la posterorrotación de estas estructuras durante el sueño con el fin de reducir el colapso de las vías aéreas superiores.

Objetivos: El objetivo general de nuestro trabajo fue lo de individualizar a los sujetos con síndrome de SAHS y hacer una evaluación multidisciplinar para definir la tipología de SAHS a la que pertenece y establecer los aparatos o prótesis orales más indicadas para esta patología.

Metodología: Para realizar el trabajo hemos consultado artículos y revistas científicas de impacto sobre el SAHS, en particular hemos analizado artículos de Pubmed, Medline, Scielo, Líneas guía de la Sociedad Americana del Sueño y Cochrane publicados en los últimos veinte años.

Discusión: Los dispositivos de avance mandibular MAD se emplearon en el tratamiento del ronquido y SAHS cuando la CPAP no es tolerada por parte del paciente.

Estos dispositivos han mejorado los valores polisomnograficos del SAHS, la desaturación de oxígeno, la tipología del sueño y el número de arousals. El fenómeno conocido con el nombre de arousals se caracterizaba por activaciones del cerebro que despertaba al sujeto provocando la activación de los músculos dilatadores de la faringe con la consiguiente suspensión de la

apnea; a continuación, se tenía tres o cuatro respiraciones profundas para estabilizar el nivel de oxigenación.

Conclusiones: Para realizar un tratamiento lo más correcto posible hay que tener un abordaje multidisciplinar en el que se tiene que trabajar en equipo con diferentes profesionales del campo de la salud.

Abstract:

Sleep apnea-hypopnea syndrome (OSAS) was characterized by recurrent episodes of partial obstruction (hypopnea) or total obstruction (apnea) of the upper airways (VAS). These caused a collapse of VAS with reduced oxyhemoglobin levels and micro-arousals with unsatisfactory sleep, excessive daytime sleepiness, respiratory and cardiac disorder.

For treating OSAS we had different types of treatments, such as mandibular advancement devices (MAD), which are the most used in patients who did not tolerate treatment with CPAP (continuous positive airway pressure). These devices favored mandibular advance, stabilized and repositioned the hyoid bone and the jaw preventing the posterior rotation of these structures during sleep in order to reduce the collapse of the upper airways.

Objectives: The main objective of our work was to individualize subjects with OSAS syndrome and to make a multidisciplinary evaluation to define the type of SAHS to which it belongs and to establish the most suitable oral devices or prostheses for this pathology.

Methodology: To carry out the work we have consulted articles and impact scientific journals on OSAS, in particular we have analyzed articles from Pubmed, Medline, Scielo, Guide Lines of the American Dream Society and Cochrane published in the last twenty years.

Discussion: The mandibular advancement devices MAD were used in the treatment of snoring and OSAS when CPAP is not tolerated by the patient.

These devices have improved the polysomnographic values of OSAS, oxygen desaturation, sleep typology and the number of arousals. The phenomenon known as arousals was characterized by activations of the brain that awakened the subject and causes the activation of the dilating muscles of the pharynges with the consequent suspension of apnea; due to this fact we will have three or four deep breaths to stabilize the oxygenation level.

Conclusions: To carry out the most correct treatment possible you have to have a multidisciplinary approach in which you have to work as a team with different professionals in the field of health.

Índice

Introducción

El síndrome de la apnea hipopnea del sueño (SAHS) se caracteriza por una alteración respiratoria y del sueño con consiguiente obstrucción intermitente y repetida de las vías aéreas superiores por lo que concierne al aérea orofaríngea.

El SAHS es una patología muy frecuente que afecta más a nuestra población. Estudios recientes afirman que tiene una prevalencia del 17% en las mujeres y del 34% en los hombres. (1)

Las patologías respiratorias se dan con episodios frecuentes durante el sueño y se pueden distinguir entre dos patrones:

- Apnea obstructiva; se define cuando hay una oclusión de las vías aéreas.
- Hipopnea se caracteriza por una reducción por lo menos del 30% del flujo respiratorio acompañada usualmente por una desaturación de oxígeno. (2)

Ambas pueden ser acompañadas por episodios de arousals, que son activaciones del cerebro que despierta al sujeto y provoca la activación de los músculos dilatadores de la faringe con la consiguiente suspensión de la apnea, por esto el sujeto realiza 3-4 respiraciones profundas para estabilizar el nivel de oxigenación.

En la mayoría de las veces, al despertarse el paciente no recuerda nada y son episodios de corta duración, a veces algunos refieren haber tenido una sensación de ahogamiento.

Este síndrome tiene el acrónimo de OSAS (obstructive apnea syndrome) en la literatura anglosajona, en cambio se define SAHS (síndrome de apnea e hipopnea del sueño) en España.

Es muy difícil realizar un diagnóstico correcto de SAHS, por esto la Asociación Americana del Sueño lo define como la presencia de por lo menos cinco episodios de apnea hipopnea cada hora acompañados por síntomas clínicos característicos como ronquidos, sueño intermitente y somnolencia diurna. (3)

Con la tercera clasificación internacional de trastornos del sueño (ICSD-3) se define SAHS cuando hay uno o más de estos signos y síntomas: somnolencia diurna excesiva, sueño irregular, cansancio e insomnio, despertarse con sensación de ahogamiento, ronquidos nocturnos de diez segundos de duración.

La somnolencia diurna es muy frecuente y se asocia a accidentes de tráfico, laborales, con trastornos de la conductas y deterioro intelectual.

Estas patologías suelen asociarse y tener una fuerte relación con patologías como la hipertensión, trastorno del humor, síndrome coronario aguda, ictus, descompensación cardiaca y diabetes mellitus tipo II. (2)

Hay también otros factores como el tabaco y el alcohol que presentan un papel de relieve en dicho síndrome.

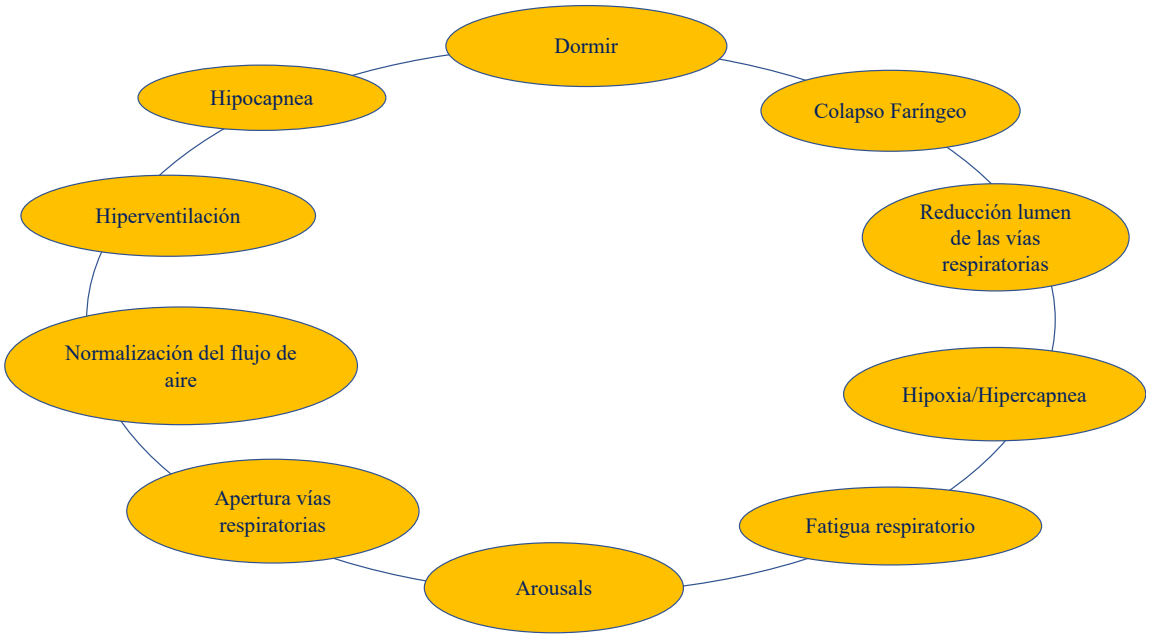
Su diagnóstico definitivo se realiza mediante el examen de polisomnografía, que mide los eventos de tipo obstructivo durante una hora de sueño o mediante la poligrafía en el que evaluamos cuantos eventos respiratorios de tipo obstructivo tenemos en una hora de monitorización.

Mediante estos exámenes se obtiene el índice de apena- hipopnea (IAH) que es la suma de los eventos respiratorios, apnea y hipopneas en una hora de sueño y el índice de trastornos respiratorios (RDI) que es la frecuencia media de las apnea- hipopnea en una hora, más los esfuerzos respiratorios. (4)

Se pueden clasificar en tres tipos de SAHS:

- SAHS leves cuando hay IAH entre 5-15,
- SAHS moderada IAH entre 15-30,
- SAHS severa IAH> 30 (5)

Los índices predictivos para la SAHS difieren entre ellos muy poco en las patologías graves, aunque en la leve podemos encontrar una notable discrepancia entre IAH y RDI. En estas situaciones es de vital importancia y el más fiable el cálculo del RDI en cuanto que un RDI elevado con un IAH bajo nos puede ayudar en la identificación de una patología respiratoria durante el sueño. Con un RDI de 5 ya se considera patológico, aunque estudios ponen niveles entre 10 y 15.



Charles Dickens fue el primero que utilizó el término “apnea obstructiva del sueño” para describir un paciente en el *The Posthumous Papers of the Pickwick Club* publicado en el 1836. (7)

Después Guilleminault *et al.* estudiaron el síndrome de apnea del sueño y el síndrome de la apnea obstructiva del sueño y afirmaron que se podía encontrar en los niños y en sujetos no obesos. (8)

En 1982 *Guilleminault et al.* descubrieron que durante el sueño algunos pacientes presentaban esfuerzos respiratorios anormales sin apneas en niño y la definió síndrome de resistencia aumentada a las vías aéreas superiores SRAVAS, este descubrimiento se verificó también en los adultos. (9)

El aparato respiratorio de las vías aéreas superiores está compuesto por un conducto de tejido blando soportado por diferentes músculos, entre ellos el músculo tensor del velo del paladar y el músculo geniogloso, juntos colaboran con los músculos del diafragma y de la caja torácica.

El funcionamiento está regulado por estímulos y reflejos de las vías aéreas superiores que controlan las dimensiones y las contracciones de la VAS (vía aérea superior).

Este procedimiento es controlado durante la vigilia, en cambio durante el sueño los estímulos y los reflejos se reducen y por esto disminuye el flujo y el lumen de la VAS.

La vía aérea superior está formada por nasofaringe, orofaringe e hipofaringe. En la orofaringe se encuentran la lengua, los dientes, el maxilar, la mandíbula, el paladar duro y blando, la úvula, las amígdalas y el hueso hioides.

Si el sujeto duerme en posición supina los músculos se relajan y la lengua se acerca a la faringe reduciendo de esta manera el flujo de aire y por esto, es oportuno fomentar la cantidad de aire para que los niveles de saturación de oxígeno se acerquen a los valores normales en los pulmones.

De esta manera, se produce el fenómeno que se conoce como ronquido debido a la vibración de los tejidos blandos. (2)

Podemos tener una limitación del flujo aéreo leve que afecta superficialmente la actividad respiratoria o en cambio, más severa con disminución importante de la cantidad de aire que puede llevar a una obstrucción parcial o total de la VAS.

La obstrucción parcial de la VAS se caracteriza por ronquidos, en cambio en la total tenemos ronquidos entre una apnea y la siguiente.

Durante la obstrucción parcial o total se intensifican los esfuerzos respiratorios que favorecen el desbloqueo de la obstrucción que usualmente se produce por medio de un arousal. (10)

Durante un arousal lo que se produce es una hiperventilación con la subida y bajada de la tensión arterial, frecuencia cardiaca y de la saturación de oxihemoglobina que lleva a la hipoxia intermitente que puede generar estrés vascular, disfunción endotelial con los consiguientes problemas de tipo cardiovascular.

La entidad de la obstrucción es diferente de un individuo a otro, y en el mismo sujeto podemos tener diferentes tipologías de obstrucciones.

Entre los factores relacionados con la SAHS encontramos aspectos fisiológicos, anatómicos y clínicos. Para realizar un correcto diagnóstico de dicho síndrome necesitamos conocer si el sujeto presenta ronquidos habituales, apneas referidas por su pareja y somnolencia diurna.

La somnolencia diurna es uno de los síntomas fundamentales de las SAHS y afecta desde el 40% al 60% de los sujetos que sufren de este síndrome y presentan AHI>5 y la somnolencia no está relacionada a la gravedad del síndrome. (11)

Para su correcta evaluación tenemos métodos subjetivos a través de la clínica, preguntando al paciente cuando lo presenta o cuando le aparece. (12) El método más empleado es la escala de evaluación de Epworth.

Escala de sueño de Epworth.
PREGUNTA ¿Con qué frecuencia se queda Ud. dormido en las siguientes situaciones? Incluso si no ha realizado recientemente alguna de las actividades mencionadas a continuación, trate de imaginar en qué medida le afectarían.

Utilice la siguiente escala y elija la cifra adecuada para cada situación.
- 0 = nunca se ha dormido
- 1 = escasa posibilidad de dormirse
- 2 = moderada posibilidad de dormirse
- 3 = elevada posibilidad de dormirse

Situación	Puntuación
• Sentado y leyendo	
• Viendo la T.V.	
• Sentado, inactivo en un espectáculo (teatro...)	
• En auto, como copiloto de un viaje de una hora	
• Recostado a media tarde	
• Sentado y conversando con alguien	
• Sentado después de la comida (sin tomar alcohol)	
• En su auto, cuando se para durante algunos minutos debido al tráfico	
Puntuación total (máx. 24)	

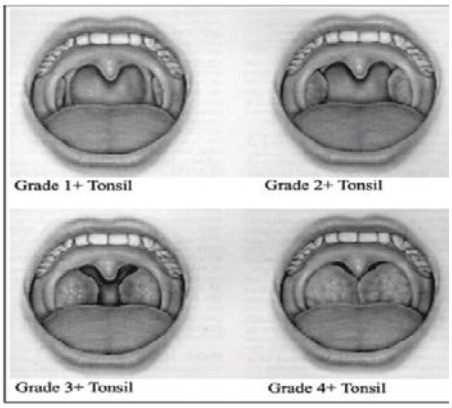
Escala de Epworth (13)

Esta escala releva situaciones determinadas en un tiempo definido, como el último mes; una puntuación superior a 10 indica patología, en cambio superior a 14 nos indica somnolencia fuertemente patológica. Los métodos objetivos para evaluar el SAHS son muy complejos de llevar a cabo y también costosos y por esto, se emplean poco y un ejemplo de estos es la polisomnografía y la prueba de mantenimiento de la vigilia.

Con el fin de llevar a cabo una escrupulosa anamnesis clínica es oportuno evaluar algunos factores predictivos de la SAHS como:

- Indice de masa corporal BMI> 30
- Distribución adiposa en la circunferencia del cuello (>43 cm hombre y >41 cm mujeres) se considera uno de los factores más importantes y se relaciona con la gravedad del SAHS y es independiente de la obesidad del paciente. (14)
- Sexo: hombre>mujer de 3/1 a 5/1 en las mujeres aumenta la incidencia en la menopausia
- Edad: es una media entre 40 y 65 años, aunque después de los 65 años el porcentaje permanece estable, en cambio en las mujeres hay un aumento debido a la menopausia. (15)
- Factor hereditario
- Obstrucciones: Mediante la orofaringoscopia podemos evaluar la hipertrofia de la úvula, de los tejidos blandos de la faringe, la cavidad oral, el volumen lingual y la hipertrofia amigdalar, que se puede clasificar con el grading amigdalar. (16)
- Paladar blando ojival, macroglosia que reduce el espacio de la lengua, todos estos factores favorecen la reducción del lumen de las vías aéreas.
- Macroglosia evaluable con la escala de Mallampati modificada por Friedman. (17) con el que se puede evaluar el espacio ocupado por la lengua en la cavidad oral.

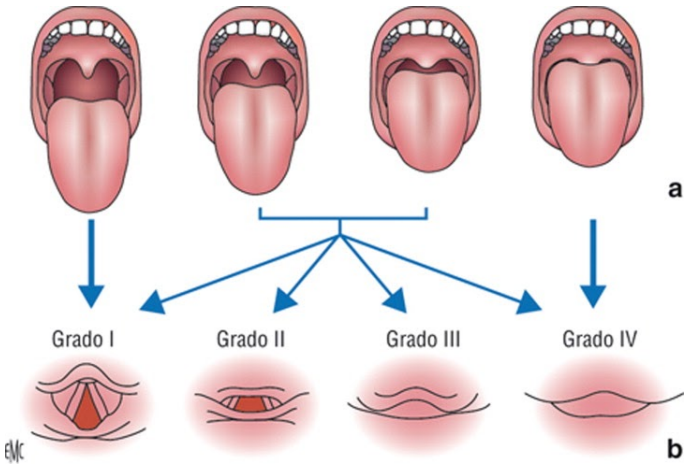
Grading amigdalar



(18)

Se clasifica en: grado I amigdalectomía, grado II amígdalas atróficas intravelicas, grado III amígdalas visibles que salen del pilar anterior y grado IV amígdalas hipertróficas que ocupan un espacio que corresponde a ¾ del istmo de las fauces.

Escala de Mallampati modificada por Friedman



(19)

En el grado I se observan amígdalas, pilares y paladar blando, en el grado II se observa; úvulas, pilares y amígdalas superiores visibles, grado III se ve solo en parte el paladar blando y el grado IV se observa solo el paladar duro, no el blando.

La escala de Mallampati evalúa la obstrucción faríngea diurna y los sujetos de clase III y IV pueden tener colapso de las paredes faríngeas en el sueño.

En la literatura, algunos autores refieren fundamental el papel que reviste el estudio cefalométrico con telerradiografía lateral, en cambio otros no lo consideran esencial a la hora de llegar a un correcto diagnóstico. (20)

Los aspectos que son más relevante en este tipo de síndrome son:

- Espacio aéreo posterior (PAS) disminuido
- Espacio plano mandibular- hueso hioideo (PM-Hy) aumentado
- Medida del paladar blando (SNP-P) aumentada
- Base anterior del cráneo (SN) disminuida
- Retrusión mandibular ángulo (SNB) aumentado (21)

En los sujetos afectos por edentulismo total tenemos una disminución del PAS (espacio aéreo posterior y retrofaríngeo) debido a la reducción de la DV (dimensión vertical). (22)

Por esta razón, algunos autores aconsejan llevar la prótesis durante la noche para mantener una vía aérea pervia. El edentulismo es un factor de riesgo de la SAHS por las alteraciones anatómicas que produce como reducción del espacio vertical, rotación anti-horaria de la mandíbula y desplazamiento posterior del complejo mandíbula-base de la lengua.

Un estudio demuestra que dormir con la prótesis disminuye el porcentaje de pacientes con SAHS. (23)

Para realizar un correcto diagnóstico es oportuno realizar un abordaje multidisciplinar en el que trabajan diferentes profesionales como el odontólogo, ortodoncista, cardiólogo, neumólogo, otorrinolaringólogo y neurólogo.

Actualmente la situación del SAHS en España se encuentra por debajo de cifras reales porque no se efectúan los *screening* necesarios en la población de riesgo, por esto muchas personas, que sufren de esta patología no se diagnostican y tratan correctamente. Esto es debido a los altos costes que se necesitan para realizar un correcto diagnóstico , además, el bienestar económico favorece la obesidad, el consumo de alcohol y tabaco que influyen negativamente en la aparición de esta patología.

Para el futuro, es fundamental realizar una correcta prevención primaria, mediante el empleo de medidas higiénicas y dietéticas y actuar a través de una prevención secundaria mediante el control de los factores de riesgos.

Los sistemas sanitarios nacionales tienen que favorecer el desarrollo de servicios odontológicos especializados en la diagnosis del SAHS, en los que se pueden tratar los pacientes que manifiestan esta patología con el fin de favorecer un tratamiento adecuado de dicho síndrome. El tratamiento precoz es fundamental para mejorar este problema de salud publica que tiene un papel relevante debido a su alta prevalencia, las comorbilidades asociadas, y la repercusión en la salud y calidad de vida del paciente.

Esta patología tiene un elevado impacto económico y social debido al incremento de la obesidad en la población que favorece el riesgo de esta enfermedad.

Objetivo

El objetivo general de nuestro trabajo se centra en individualizar a los sujetos con síndrome de SAHS y hacer una evaluación multidisciplinar para definir la tipología de SAHS a la que pertenece y establecer los aparatos o prótesis orales más indicadas para esta patología.

El objetivo principal es el tratamiento de la apnea mediante prótesis oral, haciendo hincapié en el tratamiento con OD (Oral Devices) y en particular con MAD (mandibular advancing devices) y TRD (Tongue Retaining Devices).

El objetivo secundario es comparar los diferentes aparatos y los resultados que se van a obtener, junto con sus efectos.

Metodología

Para realizar el trabajo hemos consultado con artículos y revistas científicas de impacto sobre el SAHS, en particular hemos analizado artículos de Pubmed, Medline, Scielo, Líneas guía de la Sociedad Americana del Sueño y Cochrane.

Hemos analizado estudios epidemiológicos, de diagnóstico y tratamiento del paciente con SAHS publicados en los últimos veinte años.

Las palabras claves empleadas han sido: Oral treatment of sleep apnea, sleep disorders, obstructive sleep apnea, oral appliances, sleep apnea syndrome, aparatología intraoral, mandibular advancement, obstructive sleep apnea, oral appliances, orthodontics; ortodoncia, síndrome de apnea del sueño, sleep disorder, MAD y TRD, Sleep Apnoea, Herbest, NAPA, Klearway, TAP, SomnoDent Flex y OrthoApnea.

Obstructive OR Sleep Apnoea OR Sleep Apnoea OR Sleep Breathing Disorder OR Sleep Respiratory Disorder AND Mandibular Advancement Device.

Criterios de inclusión: artículos que relacionan el uso de aparatología MAD con el tratamiento del síndrome de apnea del sueño, artículos sobre el tratamiento MAD de los últimos 15 años, artículos que comparan diferentes tratamientos del SAHS, artículos de impacto, artículos en inglés, italiano y español.

Criterios de exclusión: Artículos sobre ronquidos en los niños, artículos de más de 20 años y artículos de revistas que no sean de impacto científico.

Discusión

El objetivo del tratamiento del SAHS es favorecer un equilibrio por lo que concierne al índice IAH, normalizar los niveles de la hemoglobina y favorecer una buena calidad del sueño. En general, es oportuno reducir los factores de riesgo que pueden contribuir al empeoramiento del SAHS.

El tratamiento de elección es la CPAP (presión positiva continua sobre las vías aéreas), siguen la cirugía y los OR (Oral Devices), juntos con la medida higiénico-dietética. (2)

Los Oral devices se pueden clasificar en tres tipologías diferentes:

- Los dispositivos de retención de la lengua (TRD),
- Los dispositivos de adelantamiento mandibular (MAD),
- Los elevadores del paladar blando y reposicionamiento de la úvula.

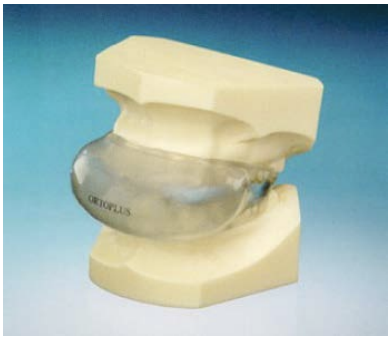
Entre los Oral Devices encontramos los aparatos para recolocar anteriormente la lengua que sirven para fijarla en una posición más adelantada sin provocar el avance mandibular, de esta manera se favorece el aumento de la VAS y se regulariza la función del músculo geniogloso. (24, 25)

De esta tipología tenemos tres dispositivos de retención de la lengua:

- Tongue Retaining Devices (TRD),
- Tongue Locking Devices (TLD),
- Tepper Oral Proprioceptive Stimulator (TOPS). (26, 27, 28)

El Tongue Retaining Devices (TRD) es un aparato que está constituido por acrílico blando y tiene un bulbo en la parte anterior donde se coloca la punta de la lengua de manera retentiva creando una presión negativa que provoca un efecto de succión y esto lleva a la protrusión de la lengua durante el sueño con consiguiente aumento de las paredes de la faringe. (29)

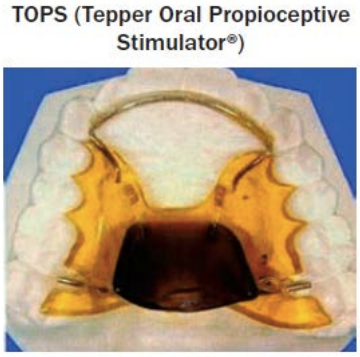
Fue el primer dispositivo a ser empleado y fue ideado por Charles Samelson con el Sleep Disorder Center de la Medical School de Chicago para disminuir los ronquidos que él tenía durante la noche. Está aprobado por la FDA como tratamiento de la apnea y se pueden emplear en los pacientes edéntulos. No se considera eficaz en apnea severa y moderada.



Tongue Retaining Devices (TRD) (32)

El Tongue Locking Devices (TLD) presenta la misma función del TRD, tiene un diseño ligeramente diferente y provoca la tracción de la lengua hacia adelante provocando un efecto al vacío y está aprobado por la FDA.

El último aparato de tracción lingual es el TOPS está compuesto por una placa acrílica maxilar estático a la que está anclada una placa móvil mediante dos charnelas. Se activa con cadeneta elástica conectada a dos ganchos de bola a los lados de la placa palatina. En la zona anterior presenta una barra lingual conectada con la placa maxilar estática que actúa favoreciendo una bajada lingual en el área posterior, en cambio la barra lingual favorece la estimulación propioceptiva y una recolocación anterior de la lengua. (28)



(30)

El segundo grupo de Oral Devices son los dispositivos de adelantamiento mandibular (MAD) son los más empleados para el tratamiento del SAHS, su mecanismo de acción es favorecer un avance mandibular aumentando el espacio aéreo posterior a nivel faríngeo y permitiendo así un adelantamiento y una bajada de la mandíbula. (31)

Todo esto lleva a una posición más adelantada del hueso hioides cambiando el equilibrio de la musculatura suprahioidea con aumento del volumen y permeabilidad de la VAS.

Este cambio está comprobado por Cobo y Cols. en sus estudios. (32)

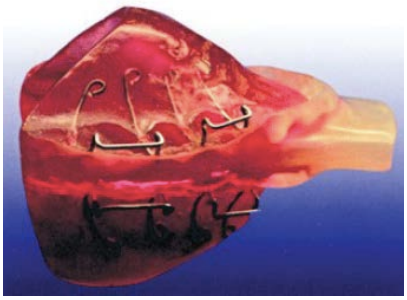
Los MAD representan un tratamiento de elección en los pacientes que presentan SAHS leve y moderada y se consideran una opción de tratamiento en las personas que no toleran la CPAP (presión positiva continua de las vías aéreas) y cirugía. (33)

A finales de los años 80 y a principio de los 90 aparecieron al mercado los primero MAD en monobloque de acrílico y se publicaron estudios sobre su funcionamiento en el *New England Journal of Medicine* por Peter George, entre estos había el NAPA (Nocturnal Airway Patency Appliance).

Los dispositivos MAD que se emplean actualmente para el tratamiento del SAHS son:

- Nocturnal Airway Patency Appliance (NAPA),
- Klearway,
- Thornton Adjustable Positioner (TAP),
- Intraoral Snoring- Therapy appliance (IST),
- Herbst,
- Twin- Block,
- SomnoDent Flex,
- SomnoDent Edentulous,
- SomnoDent Fusion,
- Narval CC,
- OrthoApnea,
- Silensor.

El NAPA es un aparato monobloque de acrílico con ochos ganchos de Adams, permite un adelantamiento mandibular y se emplea para estabilizar la mandíbula y aumentar la dimensión vertical. Está aprobado por la FDA para el tratamiento de la SAHS y de los ronquidos en los adultos. Estudios demuestran que hay una reducción del 80 % de la patología. (34)



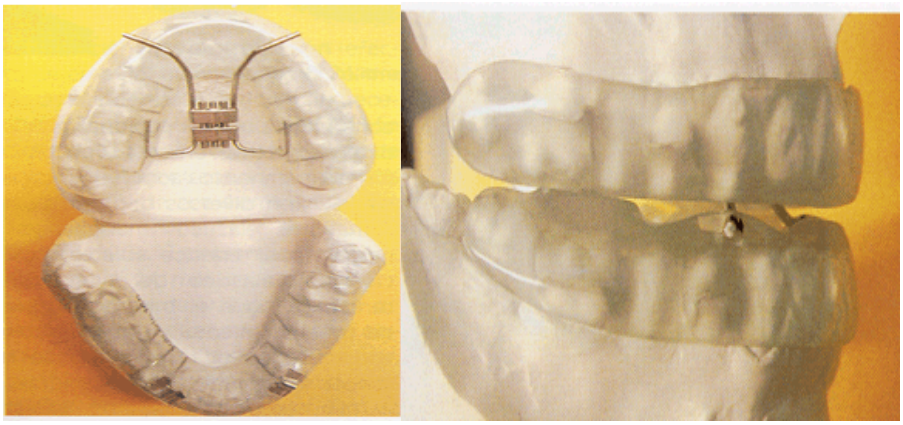
NAPA (33)

Después del NAPA se desarrollaron aparatos bimaxilares que favorecen movimientos de lateralidad y verticalidad de la mandíbula como el Klearway, que está constituido por dos férulas acrílicas termoactivas que favorecen su inserción en la boca del paciente calentándolo con agua, y luego una vez introducido en la boca se vuelve rígido permitiendo así una estabilidad del aparato.

El NAPA ha sido el pionero en los dispositivos de avance mandibular graduales y regulables; la regulación la gestiona el paciente mediante la activación del tornillo de disyunción localizado en una posición central en la parte superior del dispositivo.

Este aparato favorece el adelantamiento gradual de la mandíbula con la activación del tornillo de 0,25 mm a la vez y favorece un movimiento anteroposterior hasta 11 mm. Se puede emplear

también en pacientes con leve patología de ATM y bruxismo; permite pequeños movimientos mandibulares como bostezos, tragar y beber sin quitarse al aparato. (35)



Klearway (28)

El TAP (Thorton Adjustable Positioner) ideado en 1996 está compuesto por dos férulas, una superior y otra inferior unidas mediante un gancho superior conectado a una barra lingual.

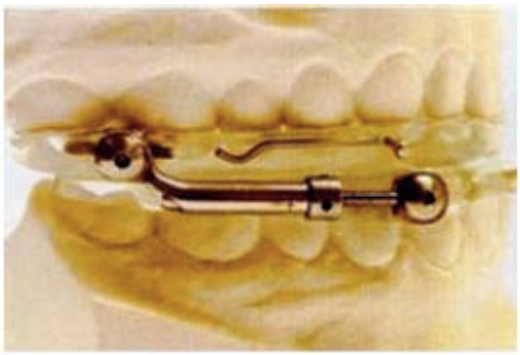
Este mecanismo limita la abertura mandibular y favorece movimientos laterales mediante la barra.

TAP (30)

Su efecto negativo es que ocupa parte del espacio de la lengua y es por esto, que ha sido modificado a lo largo de los años para disminuir su dimensión y para tener mayor aceptación por parte del paciente. Presenta un adelantamiento gradual con rotación de 180° en sentido horario. (36)

Para favorecer la comodidad de estos aparatos se ha mejorado la abertura mandibular como se puede ver en los aparatos IST (Intraoral Snoring Therapy appliance) y Herbst.

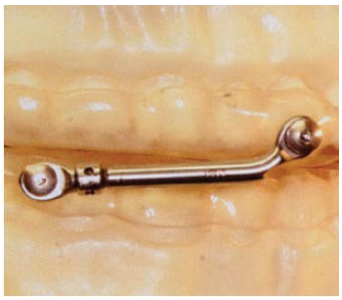
El IST es un aparato compuesto por dos brazos como el Herbst, pero en este caso los brazos son regulables y permiten controlar el adelantamiento mandibular. Esta constituido por acrílico termoactivo y permite un adelantamiento de 0,25 mm cada cuatro activaciones y cada activación corresponde a una vuelta de 90°.



IST (30)

Hay dos variantes de este aparato: el IST Classic con brazos colocados en el primer molar superior y anclada en el canino inferior y favorece movimientos de lateralidad y verticalidad, en cambio, el Classic New tiene el brazo invertido y favorece la protrusión al abrir la boca.
Se emplean tanto en el tratamiento del ronquido como del SAHS y se fabrica con un avance inicial del 75% de la máxima protrusiva. (30)

El Herbest en cambio, está compuesto por dos brazos y se clasifica como un aparato funcional que se suele emplear en los tratamientos de clase II esquelética con micrognatia mandibular para favorecer su avance.

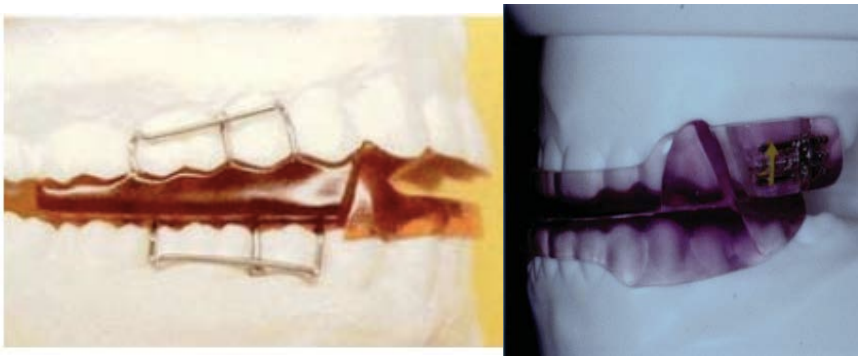


Herbst (33)

A la altura de los premolares hay dos ganchos de bola donde se anclan dos elásticos entre las dos férulas para prevenir la abertura de la boca.

Al principio para el tratamiento del SAHS se empleaban el Twin-Block constituidos por planos inclinados de acrílico con el fin de favorecer el adelantamiento mandibular, este tipo de aparato no tuvo mucho éxito en cuanto el paciente si se quedaba con la boca abierta, pero no conseguía el avance mandibular. En los últimos años Palmisano desarrolló una novedad revolucionando el Twin-Block e ideó el SomnoDent Flex. Compuesto por dos férulas con dos aletas de elevación con una inclinación de 17° que se colocan a los planos inclinados de la férula superior. El avance mandibular está regulado por un tornillo localizado en el plano inclinado superior que se activa 0,1 mm en cada activación.

Por lo que concierne la nueva versión está compuesta por un tornillo y las aletas de elevación para garantizar un mayor avance mandibular. Está construido con una resina mediante calor para garantizar la máxima retención. (2)



Twin-Block (30)

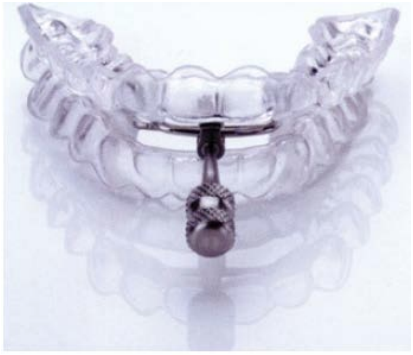
SomnoDent (33)

Existe una variante para edéntulos que es el SomnoDent Edentulous, que está constituido por un material que es el SMH Bflex retentivo y que permite el rebase, se puede emplear por edentulismo completo superior, pero tiene que presentar por lo menos cuatro dientes en la arcada inferior.

Las últimas novedades en el campo de la aparatología para el tratamiento del SAHS ha sido Narval CC construido mediante tecnología CAD/CAM, que favorece el avance mandibular a través de conectores.

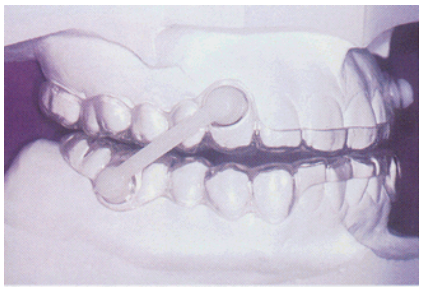
Narval CC (30)

Otro dispositivo reciénte es el OrthoApnea que favorece la abertura de la boca y la protrusión de la mandíbula.



OrthoApnea (33)

Uno de los dispositivos MAD más empleados es el Silensor compuesto por dos férulas bimaxilares unida por medios de conectores de plásticos que van de canino superior a molar inferior y favorecen el adelantamiento de la mandíbula y de su abertura de la boca para evitar el incremento de la dimensión vertical. Es muy frágil y por este motivo se emplea como aparato de prueba en los pacientes.



Silensor (28)

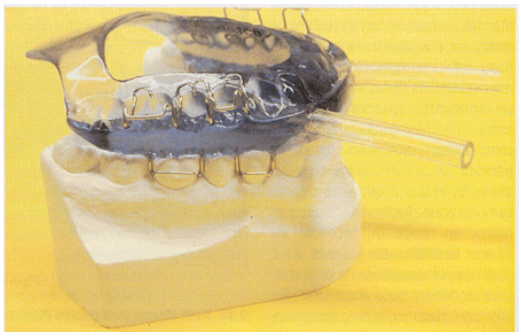
El tercer grupo de Oral Devices son la aparatología de elevación del velo del paladar y de reposicionamiento de la úvula que tiene la función de aumentar el espacio del velo del paladar y recolocar la úvula en una posición elevada con respecto a su posición habitual.

Este tipo de aparatología reduce la vibración producida por el aire cuando el sujeto duerme y de esta manera se reducen los ronquidos nocturnos del paciente. (37)

Hay dos tipologías de aparatología:

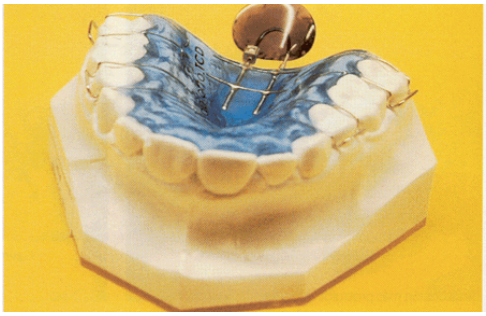
- Equalizer (Equalizer Airway Device®)
- ASPL (Adjustable Soft Palate Lifter®)

La función del Equalizer se focaliza en la elevación del velo del paladar favoreciendo un adelantamiento mandibular y por esta razón se considera como un aparato híbrido.
Está formado por dos tubos localizados anteriormente para igualar la presión de aire extraoral e intraoral. Se estabiliza mediante ganchos de Adams en los molares y de bola en los premolares y está aprobado por la FDA. (28, 38)



Equalizer (28)

El ASPL es una placa removible en el maxilar y en la zona posterior tiene un botón acrílico donde hay un tornillo de activación que permite su distalización hasta llegar al paladar blando. El paciente lo activa cada noche ⅛ está aprobado por la FDA por el ronquido.



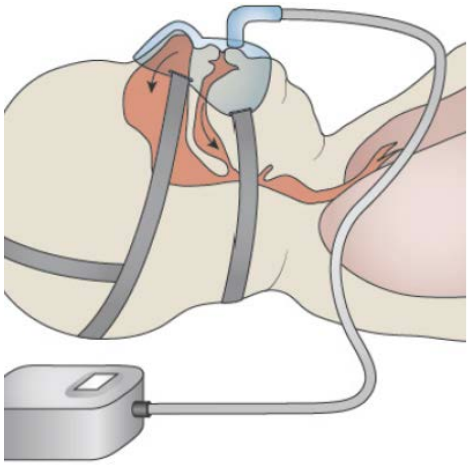
ASPL (28)

El tratamiento de elección del síndrome de SAHS severo cuando el índice de apena-hipopnea (IAH) es superior a 30 por hora y cuando el paciente presenta la siguiente sintomatología como hipersomnia diurna, problemas cardiovasculares o cerebrovasculares y problemas respiratorios, es la CPAP (presión positiva continua en la vía aérea). (39)

En la revisión realizada por Cochrane se subraya el papel de relieve que tiene la CPAP en la modificación de la calidad del sueño y del estilo de vida en pacientes con SAHS moderada y grave. Las CPAC resultó más eficaz con respecto al MAD en la reducción de los síntomas clínicos respiratorios en el sueño, en cambio no se pusieron en relieve diferencias con respecto a la somnolencia diurna. (40)

El National Institute for Health and Clinical Excelence británico (NICE) afirma que el uso de la CPAC favorece la reducción de la presión sanguínea. (41)

Otros estudios afirman que la CPAC disminuye el riesgo de accidentes de tráfico, regulariza la presión arterial, estabiliza el nivel de oxigenación y previene enfermedades cerebrovasculares y cardiovasculares. (42, 43)



CPAP (44)

Este aparato está constituido por una máscara nasal pneumatica que favorece el tránsito de aire y aumenta el flujo del VAS y está documentado por *Carrera et all.* que la CPAP establece las funciones del músculo geniogloso. (45)

Su función tiene un efecto doble, en cuanto presenta la función de soporte neumático y de restablecer la función y la estabilización de la musculatura de los tejidos blando del VAS.

El tratamiento es eficaz solo en las personas que lo emplean por al menos 4 horas durante más del 70 % de las noches y esto favorece la reducción de la apena-hipopnea del sueño y una mejor calidad de vida y del sueño. La adherencia a este tratamiento no es fácil de llevar a cabo por parte de los pacientes en cuanto es un aparato ruidoso, puede provocar sensación de ahogamiento, claustrofobia y es difícil de llevar.

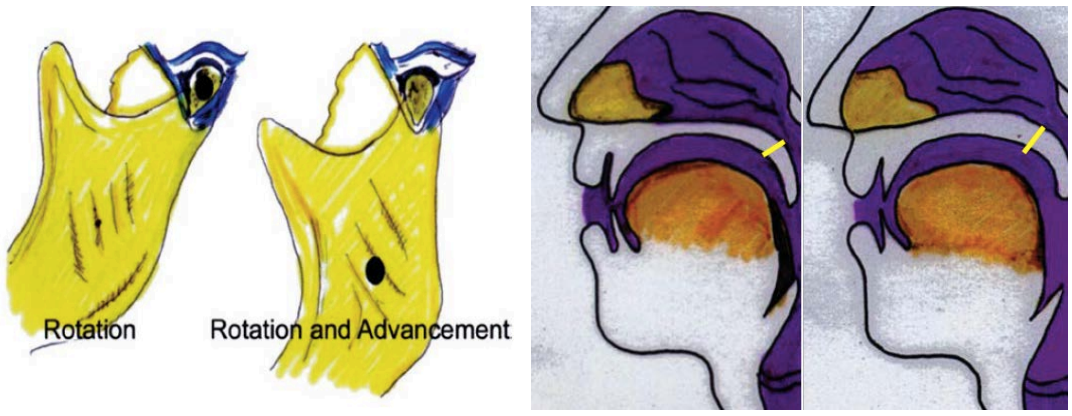
Existe una combinación de CPAP con aparatos orales para obtener mayores resultados porque el aparato oral actúa adelantando y bajando la mandíbula y la CPAP favorece el flujo de aire constante para evitar el colapso de la VAS.

LA CPAP presenta ventajas en cuanto protege desde las patologías cardio y cerebrovascular reduciendo la mortalidad en cuanto influye disminuyendo los valores de la presión sistémica. Según algunos estudios hay una relación positiva de la recuperación motora y neurología en los pacientes con historial clínico de ictus. (46)

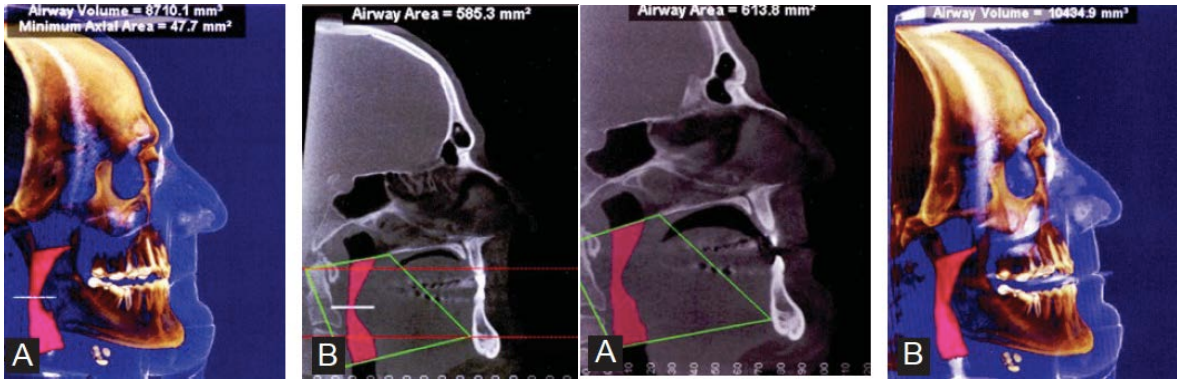
Garbarino *et all* (47) afirman que el tratamiento con CPAP del SAHS favorece una diminución del porcentaje de accidente de trafico debido a una mejor calidad de vida.

Hoy en día, en cuanto como hemos dicho anteriormente es muy difícil la adherencia al tratamiento a largo plazo del CPAP por parte del paciente, muy a menudo se emplean los MAD.

Los MAD mejoran la permeabilidad de las vías aéreas superiores durante el sueño a diferentes niveles como en el paladar blando o en la base de la lengua. Su función principal es la de favorecer una expansión lateral del VAS y estos dispositivos promueven un adelantamiento con rotación en sentido horario.



Movimiento de la mandíbula y flujo de aire vías aéreas superiores sin MAD y con MAD (33)



Cone-beam y TAC en pacientes sin MAD Cone-beam y TAC en pacientes con MAD

En la primera imagen podemos ver una reducción del espacio retro- faríngeo sin el empleo del MAD en la segunda dos imágenes vemos que con su utilizo se va aumentando este espacio. (33)

Existen diferentes tipologías de MAD como hemos enumerados antes y es fundamental para el odontólogo y sus equipos de expertos en la medicina del sueño conocer los diferentes aparatos y sus aplicaciones según la patología asociada que el paciente presenta.

Hay diferentes dispositivos según el mecanismo de avance mandibular que queremos alcanzar, de la libertad de movimiento en lateralidad y verticalidad de la mandíbula.

Esta tipología de terapia es un tratamiento que dura para toda la vida y es de particular importancia la resistencia del material y el diseño con el cual se realiza el dispositivo.

En el mercado actualmente tenemos MAD individuales o preformados, los individuales se construyen tomando impresiones al paciente y realizando un registro de mordida en cera o en silicona con avance y espesor.

Para construir estos dispositivos individuales necesitamos de mucho tiempo y los costes son elevados, aunque la adaptación del paciente al aparato es mejor en cuanto se adhiere perfectamente a la boca del paciente, en cambio, los preformados tienen un coste menor pero

no alcanzan los resultados y tiene un menor confort respecto a los individualizados para el paciente. (2)

En el mercado encontramos MAD mono o bimaxilares: Los primeros están constituidos por un solo bloque y no permiten los movimientos de la mandíbula, en cambio los bimaxilares están formados por dos bloques que producen un adelantamiento mandibular y movimientos de lateralidad y verticalidad.

Por lo que concierne a la eficacia del monobloque o los bimaxilares no se encuentran diferencias importantes, aunque el monobloque presenta una mayor dificultad de adaptación y mayor dolor en el ATM.

A la hora de la realización del MAD podemos optar para un adelantamiento fijo o gradual adaptado, por parte del paciente según su tolerancia a fin de encontrar un correcto avance.

Lettieri y colaboradores en 2011 (48) han realizado un estudio comparando los resultados obtenidos en pacientes con MAD con avance fijo con respecto a pacientes con MAD con avance gradual, los de avance gradual se han demostrado más efectivos en reducir AHI.

Los MAD con avance gradual están constituidos por dos bloques que recubren las dos arcadas dentarias y se adaptan a los registros del paciente. Las dos partes están unidas por un sistema de articulación que se modula en los tres planos del espacio.

Con este aparato se puede variar la posición de la mandíbula mediante la titulación, o sea avance gradual con el fin de reducir el numero de eventos obstructivos y de tratar los síntomas.

El MAD actúa desplazando hacia delante el conjunto lengua-mandíbula, incrementando las dimensiones anteroposterior y trasversal de la orofaringe, realiza la tracción del hueso hioides y reduce la verticalización de la lengua.

Las características ideales del MAD son la individualidad, la titulación del aparato, la completa cobertura oclusal, planos posteriores rígidos y liso y mínimo obstáculo para la lengua; tiene que ser resistente ante cualquier tipo de fuerza, agente físico y químico y además ser confortable.

Los efectos intrínsecos al empleo del MAD son; leve dolor muscular y articular, sialorrea, sequedad de la boca, problemas oclusales, dolor de ATM y modificaciónes oclusales importantes como la reducción del resalte y de la sobremordida, el aplanamiento de la curva de Spee y las variaciones en la relación anteroposterior.

Indicaciones actuales

Según los últimos estudios, los pacientes con roncopatía simple, SAHS leve y algunos casos de SAHS moderado pueden ser tratados con los MAD, aunque algunos estudiosos afirman que el nivel de gravedad del SAHS no es un factor de limitación en el tratamiento de estos pacientes con el MAD. (49-51) Existen algunos casos de SAHS severo que han sido tratados mediante dispositivos de avance mandibular con éxito.

En los pacientes tratados mediante uvulopalatofaringoplatia (UVPPP) se ha conseguidos resultados a los 6 meses comparable a lo que han sido tratados con MAD; aunque después de los seis meses los MAD han garantizado el mantenimiento de los resultados conseguidos a largo plazo con respecto a UVPPP.

En los casos en lo que la UVPPP no ha logrado los resultados esperados, el MAD puede ser considerado un tratamiento de elección para mejorar el 50% de los casos. (48)

En la literatura científica se evidencia que las prótesis de avance mandibular tienen un mayor grado de adhesión al tratamiento con porcentaje de resultados que oscilan entre un 76% y 95%, aunque faltan estudios y resultados que demuestran la efectividad a corto y largo plazo de los MAD.

Preparación clínica del MAD

Toma de impresión en la que se puedan observar todos los detalles anatómicos como los dientes, paladar y arcadas; toma de los registros de cera en relación céntrica y de la elevación vertical y del avance mandibular.

Solamente se considera ideal un avance del 75% de la máxima protrusión y el método más empleado es el George Gauge que evalúa la posición habitual, la máxima protrusión y el adelantamiento inicial.

El George Gauge esta constituido por una horquilla que presenta un calibre milimetrado con diferentes alturas y tamaños. La altura de la horquilla representa el espesor vertical anterior.

Posicionamos la horquilla en la charnela de manera que la horquilla puede moverse hacia atrás y adelante, el paciente tiene que morder en posición habitual y luego lo llevamos a máxima protrusión.

Luego elegimos el avance ideal para empezar el tratamiento para nuestro paciente y después ponemos la silicona para tomar el registro y comprobamos los contactos.

Si el paciente es desdentado empleamos cera para tomar el registro o duplicamos la prótesis total del paciente con un molde en silicona.

En el momento de la entrega es importante evaluar que el aparato sea la reproducción fiel de la boca del paciente, que sea adherente y retentivo y que no comprima los tejidos blandos y que no provoque ulceraciones ni lesiones orales.

Es importante que el paciente lo lleve por lo menos durante cinco minutos para comprobar si hay compresión de algunas aéreas y si el paciente tolera la protrusión realizada.

Si el paciente presenta sensación de malestar tenemos que reducir la protrusión y una vez entregado el aparato se le explica los efectos secundarios que puede presentar y se informa

sobre los ejercicios a realizar si se encuentra con una oclusión diferente a la hora de quitar el dispositivo de la boca, debido a la contracción prolongada del pterigoideo lateral.

Los ejercicios que realiza son:

-Abrir y cerrar la boca poniendo la punta de la lengua en una posición más retraída en el paladar,

-Morder durante algunos segundos una mordida o alineador con la mordida de cierre habitual en material termoplástico suave.

Se aconseja llevar el aparato al principio durante el día para favorecer la adaptación del paciente, tenemos que explicarle como se inserta y se quita el aparato y como realizar su activación si presenta tornillo.

Para controlar la abertura de la boca es útil emplear elásticos blandos y cortos. (3)

Es de vital importancia realizar una titulación que como ya hemos dicho es una búsqueda del avance mandibular ideal para reducir el número de procesos obstructivos, de manera que permita tratar los síntomas.

Es útil considerar la gravedad de la patología que presenta el paciente y la capacidad del paciente de adaptarse al primer avance. Una vez alcanzada la posición deseada tenemos que realizar una monitorización cardio-respiratoria o una polisomnografía tutelada por un médico experto en los trastornos del sueño.

El primer control definido también *follow-up* se realiza a las dos semanas de la entrega del aparato y se comprueba el bienestar subjetivo y el confort. Los siguientes controles son útiles para gestionar el protocolo de titulación, evaluar la mejora de la sintomatología subjetiva y cuanto el paciente tolera el avance.

Una vez llegados al avance final el paciente tiene que ser evaluado por el especialista del sueño para el control polisomnografico y obtenido el resultado objetivo, los controles se harán a los 6

meses y luego al año con el fin de evaluar las modificaciones oclusales y comprobar que no se realice un empeoramiento de la sintomatología.

Si se verifica un empeoramiento de la sintomatología el paciente se tiene que enviar de nuevo al especialista del sueño, en cambio si el resultado obtenido no es lo esperado con respecto a la reducción de los eventos obstructivos y la mejora de la sintomatología, el odontólogo evaluará si aumentar el avance o proponer una terapia combinada con MAD y otro tratamiento.

La tendencia futura es la de desarrollar protocolos, plan de tratamiento para la prevención y cura del SAHS. Intentar definir líneas guía comunes y realizar estudios sociosanitarios para evaluar en manera continua a lo largo del tiempo la evolución de los tratamientos de esta patología e invertir sobre la búsqueda científica en cuanto esta es una enfermedad que tiene un elevado impacto económico.

Conclusiones

1) El SAHS se define en la sociedad como un problema de salud pública debido a su tasa de prevalencia, por las comorbilidades asociadas y por los efectos que produce en la salud.

2) Se considera una patología que provoca costes económicos elevados con consecuencias sociales importantes que pueden conducir a bajas laborales y a accidentes .

3) El objetivo del tratamiento del SAHS es eliminar los síntomas y mejorar la calidad de vida de las personas afectas, de su sueño, el IAH la desaturación de oxígeno de la hemoglobina.

4) Los MAD que se emplean en el tratamiento del SAHS actúan provocando un movimiento anteroinferior de la mandíbula, inhibiendo su postero-rotación y aumentando el calibre de la VAS; estos tipos de aparatos han favorecido una mejora del IAH.

5) El tratamiento del SAHS consiste en las medidas higiénicas y dietéticas, la CPAP, la cirugía y los MAD.

6) La CPAP es el tratamiento de elección, en cuanto es la que produce mejores resultados y elimina los síntomas de la enfermedad y logra mejorar la calidad del sueño reduciendo las potenciales complicaciones.

7) Para realizar un tratamiento lo más correcto posible hay que tener un abordaje multidisciplinar en el que se tiene que trabajar en equipo con diferentes profesionales del campo de la salud.

8) Los MAD se consideran una alternativa cuando el paciente no tolera el tratamiento con CPAP y se emplean en el tratamiento del SAHS moderado y leve.

Estos dispositivos pueden producir efectos adversos como el dolor en la ATM, sensación de boca seca, inflamación de las mucosas y producen cambios oclusales como por ejemplo la reducción del resalte y de la sobremordida, el aplanamiento de la curva de Spee y las variaciones en la relación anteroposterior.

Sostenibilidad

Para mejorar el tratamiento del SAHS es necesario invertir con recursos económicos y humanos con el fin de hacer un diagnostico precoz de dicha patología. Esto es importante para limitar los daños a nivel sistémico.

De esta manera, tendremos una situación real de la incidencia de dicha enfermedad sobre la población objeto de estudio y podremos desarrollar proyectos de tratamiento para mejorar la sintomatología. Los mayores costes derivados del trabajo de búsqueda de los casos de enfermedad en la población nos permitirán ahorrar recursos a nivel económico, ambiental y social porque se va a prevenir los daños derivado del SAHS.

Todo esto nos llevará a una mejor calidad de vida, menores gastos en la curación de las enfermedades a nivel sistémico, a una disminución de los accidentes y bajas laborales.

Anexos

1. Peppard, P.E.; Young, T.; Barnet, J.H.; Palta, M.; Hagen, E.W.; Hla, K.M. Increased Prevalence of Sleep- Disordered Breathing in Adults. Am. J. Epidemiol. 2013, 177, 1006–1014.

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Original Contribution

Increased Prevalence of Sleep-Disordered Breathing in Adults

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Sleep-disordered breathing is a common disorder with a range of harmful sequelae. Obesity is a strong causal factor for sleep-disordered breathing, and because of the ongoing obesity epidemic, previous estimates of sleep-disordered breathing prevalence require updating. We estimated the prevalence of sleep-disordered breathing in the United States for the periods of 1988–1994 and 2007–2010 using data from the Wisconsin Sleep Cohort Study, an ongoing community-based study that was established in 1988 with participants randomly selected from an employed population of Wisconsin adults. A total of 1,520 participants who were 30–70 years of age had baseline polysomnography studies to assess the presence of sleep-disordered breathing. Participants were invited for repeat studies at 4-year intervals. The prevalence of sleep-disordered breathing was modeled as a function of age, sex, and body mass index, and estimates were extrapolated to US body mass index distributions estimated using data from the National Health and Nutrition Examination Survey. The current prevalence estimates of moderate to severe sleep-disordered breathing (apnea-hypopnea index, measured as events/hour, ≥15) are 10% (95% confidence interval (CI): 7, 12) among 30–49-year-old men; 17% (95% CI: 15, 21) among 50–70-year-old men; 3% (95% CI: 2, 4) among 30–49-year-old women; and 9% (95% CI: 7, 11) among 50–70 year-old women. These estimated prevalence rates represent substantial increases over the last 2 decades (relative increases of between 14% and 55% depending on the subgroup).

adult; middle age; obesity; sleep

Abbreviations: AHI, apnea-hypopnea index; BMI, body mass index; NHANES, National Health and Nutrition Examination Survey; SDB, sleep-disordered breathing.

The apnea and hypopnea events of sleep-disordered breathing (SDB) have substantial harmful health consequences. Immediate effects include intermittent hypoxia, fragmented sleep, and exaggerated fluctuations in heart rhythm, blood pressure, and intrathoracic pressure (1). In turn, these acute physiologic disruptions evolve into long-term sequelae, such as hypertension and cardiovascular morbidities (1–3), decrements in cognitive function (4, 5), mood and quality of life (6, 7), and premature death (8, 9).

In 1993, data collected over a 4-year period from the Wisconsin Sleep Cohort Study uncovered a high prevalence of SDB assessed using polysomnography in a working population–based sample of adults 30–60 years of age (10). The findings were corroborated by other US population-based studies (11), but these prevalence rates were estimated more than a decade ago (12, 13). The most important modifiable causes of SDB in adult populations are overweight and obesity. Weight gain and loss have been consistently associated with increasing and decreasing SDB severity, respectively, in observational and intervention studies (14–16). Over the last few decades, the prevalence rates of overweight and obesity experienced epidemic trajectories in the United States (17–20), which is likely to have resulted in increased occurrence of obesity-related outcomes, including SDB.

In the United States, a systematic program for monitoring SDB prevalence over time does not exist. High-quality objective assessments of SDB are time-consuming, expensive, and burdensome to subjects, typically requiring overnight continuous monitoring of multiple physiologic processes,

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Clinical Guideline for the Evaluation, Management and Long-term Care of Obstructive Sleep Apnea in Adults

Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine

Abstract

Go to:

Background:

Obstructive sleep apnea (OSA) is a common chronic disorder that often requires lifelong care. Available practice parameters provide evidence-based recommendations for addressing aspects of care.

Objective:

This guideline is designed to assist primary care providers as well as sleep medicine specialists, surgeons, and dentists who care for patients with OSA by providing a comprehensive strategy for the evaluation, management and long-term care of adult patients with OSA.

Methods:

The Adult OSA Task Force of the American Academy of Sleep Medicine (AASM) was assembled to produce a clinical guideline from a review of existing practice parameters and available literature. All existing evidence-based AASM practice parameters relevant to the evaluation and management of OSA in adults were incorporated into this guideline. For areas not covered by the practice parameters, the task force performed a literature review and made consensus recommendations using a modified nominal group technique.

Recommendations:

Questions regarding OSA should be incorporated into routine health evaluations. Suspicion of OSA should trigger a comprehensive sleep evaluation. The diagnostic strategy includes a sleep-oriented history and physical examination, objective testing, and education of the patient. The presence or absence and severity of OSA must be determined before initiating treatment in order to identify those patients at risk of developing the complications of sleep apnea, guide selection of appropriate treatment, and to provide a

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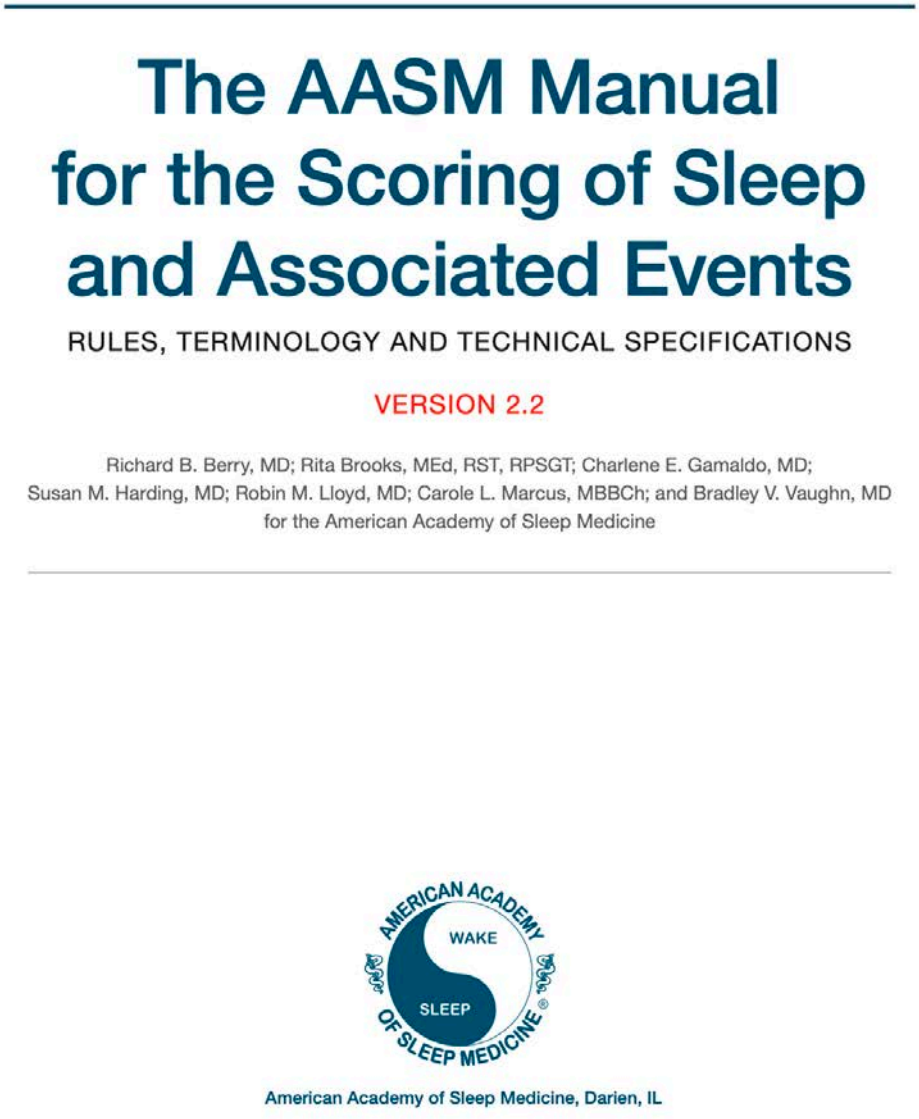

The AASM Manual for the Scoring of Sleep and Associated Events

RULES, TERMINOLOGY AND TECHNICAL SPECIFICATIONS

VERSION 2.2

Richard B. Berry, MD; Rita Brooks, MEd, RST, RPSGT; Charlene E. Gamaldo, MD;
Susan M. Harding, MD; Robin M. Lloyd, MD; Carole L. Marcus, MBBCh; and Bradley V. Vaughn, MD
for the American Academy of Sleep Medicine

American Academy of Sleep Medicine, Darien, IL

5. Linee guida nazionali per la prevenzione ed il trattamento odontoiatrico del russamento e della sindrome delle apnee ostruttive nel sonno in età evolutiva / linee guida nazionali per la prevenzione ed il trattamento odontoiatrico della sindrome delle apnee ostruttive nel sonno (OSAS) Ministero della Salute (2014).

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Linee guida nazionali per la prevenzione ed il trattamento odontoiatrico del russamento e della sindrome delle apnee ostruttive nel sonno in età evolutiva

Allegato al parere del Consiglio Superiore di Sanità – Sezione III
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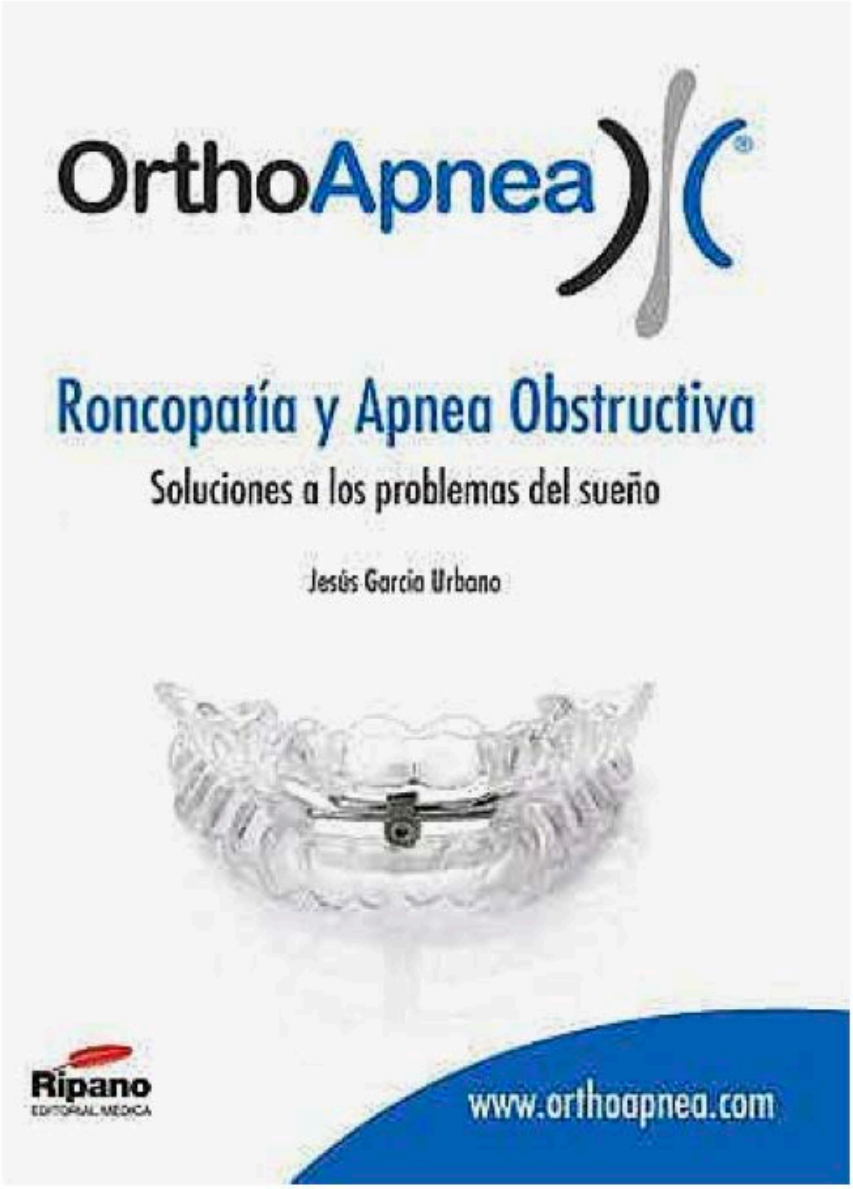

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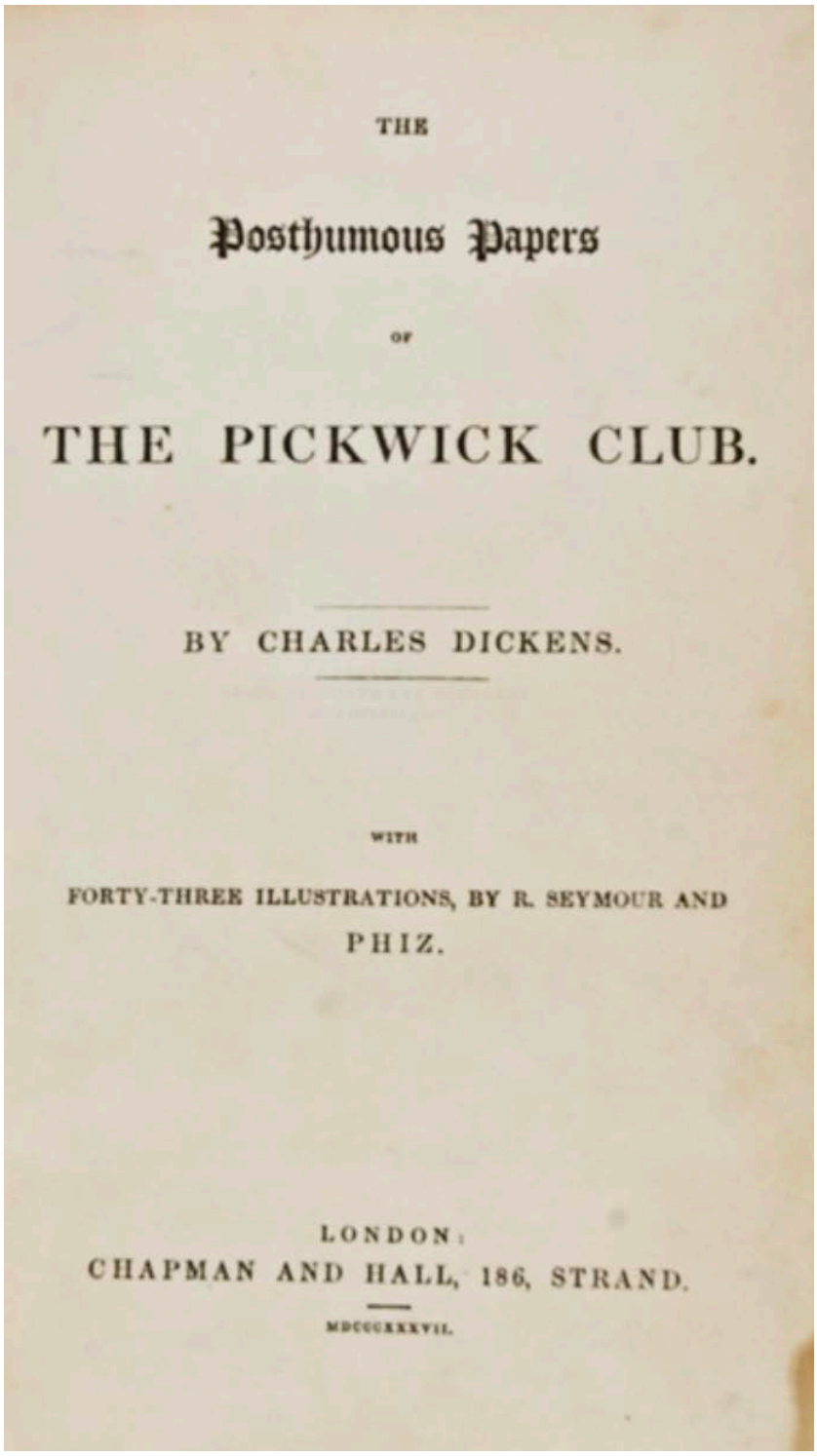

THE

Posthumous Papers

OF

THE PICKWICK CLUB.

BY CHARLES DICKENS.

WITH

FORTY-THREE ILLUSTRATIONS, BY R. SEYMOUR AND PHIZ.

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THE SLEEP APNEA SYNDROMES[1]

◆7215

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INTRODUCTION

For many years pneumologists have conducted extensive studies of alveolar hypoventilation syndromes whose hallmarks are a combination of hypercapnia and alveolar hypoxemia. Nonspecific alveolar hypoventilation can occur secondary to damaged respiratory centers in the brain, as seen in bulbar poliomyelitis (1), brain stem infarct (2, 3), bilateral cervical cordotomy (4), or the uncommon "primary" alveolar hypoventilation syndrome (Ondine's Curse syndrome), first reported by Severinghaus & Mitchell (5). A nonspecific alveolar hypoventilation can also be seen with drug intoxication (barbiturates and tranquilizers) (6) and with abnormalities of breathing apparatus, as in muscular dystrophy, kyphoscoliosis, Pierre Robin syndrome, obstructive lung disease, etc (7–10).

During the 1950s another alveolar hypoventilation syndrome received much attention from respiratory specialists. This was the Pickwickian syndrome, a term coined by Sir William Osler (11) and classically described by Burwell et al (12). In its classic form the Pickwickian syndrome includes obesity, hypersomnolence, periodic breathing with hypoventilation, and cor pulmonale. Several variants have also been described, depending chiefly on the presence or absence of cardiovascular problems and alveolar hypoventilation during wakefulness. For example, Alexander

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Identification of Upper Airway Anatomic Risk Factors for Obstructive Sleep Apnea with Volumetric Magnetic Resonance Imaging

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We used sophisticated volumetric analysis techniques with magnetic resonance imaging in a case–control design to study the upper airway soft tissue structures in 48 control subjects (apnea–hypopnea index, 2.0 ± 1.6 events/hour) and 48 patients with sleep apnea (apnea–hypopnea index, 43.8 ± 25.4 events/hour). Our design used exact matching on sex and ethnicity, frequency matching on age, and statistical control for craniofacial size and visceral neck fat. The data support our *a priori* hypotheses that the volume of the soft tissue structures surrounding the upper airway is enlarged in patients with sleep apnea and that this enlargement is a significant risk factor for sleep apnea. After covariate adjustments the volume of the lateral pharyngeal walls ($p < 0.0001$), tongue ($p < 0.0001$), and total soft tissue ($p < 0.0001$) was significantly larger in subjects with sleep apnea than in normal subjects. These data also demonstrated, after covariate adjustments, significantly increased risk of sleep apnea the larger the volume of the tongue, lateral pharyngeal walls, and total soft tissue: (*1*) total lateral pharyngeal wall (odds ratio [OR], 6.01; 95% confidence interval [CI], 2.62–17.14); (*2*) total tongue (OR, 4.66; 95% CI, 2.31–10.95); and (*3*) total soft tissue (OR, 6.95; 95% CI, 3.08–19.11). In a multivariable logistic regression analysis the volume of the tongue and lateral walls was shown to independently increase the risk of sleep apnea.

Keywords: magnetic resonance imaging; lateral pharyngeal walls; obstructive sleep apnea; parapharyngeal fat pads; upper airway

Despite the high prevalence and major public health ramifications of obstructive sleep apnea, not enough is understood about its pathogenesis or the anatomic risk factors for this condition (1). Upper airway imaging techniques have provided insight into the biomechanical basis of obstructive sleep apnea (2, 3). Studies with nasal pharyngoscopy (4–6), cephalometry (7, 8), fluoroscopy (9), conventional and electron beam computed tomography (9–13), acoustic reflection (14), and magnetic resonance imaging (MRI) (15–25) have been used to examine the anatomy of the pharynx in patients with this disorder. Such studies have demonstrated that the size of upper airway structures—tongue, soft palate, parapharyngeal fat pads, lateral pharyngeal walls, and mandible—is an important determinant of upper airway caliber in sleep apnea (9, 12, 13, 15, 17–25). However, these studies have largely examined the upper airway in two dimensions, measuring distances (i.e., thickness or length) and cross-sectional areas of upper airway structures (9–11, 15–17, 23). We believe that a two-dimensional assessment of the upper airway soft tissue structures is an inadequate characterization of a three-dimensional structure.

To fully understand the anatomic risk factors for obstructive sleep apnea, we need to examine the volume of upper airway structures, that is, using a three-dimensional approach. Although other investigators have examined the volume of upper airway soft tissue structures (20, 21) these studies had small sample sizes and did not examine all the upper airway structures comprehensively. To pursue such an analysis, we used sophisticated computer reconstruction algorithms that allowed us to move beyond the measurement of dimensions to a three-dimensional volumetric approach. We have successfully tested this three-dimensional upper airway image analysis paradigm and performed validation studies of these newly developed volumetric MRI techniques (22). The primary goal of the present investigation was to determine the anatomic soft tissue risk factors for sleep-disordered breathing by using these state-of-the-art volumetric MRI methods.

We used a case–control design to examine our *a priori* hypotheses that the volume of the soft tissue structures surrounding the upper airway was enlarged in patients with sleep apnea and that this enlargement was a significant risk factor for sleep apnea. We assessed the structural risk factors for sleep apnea, with a particular focus on volume of the lateral pharyngeal walls, tongue, soft palate, parapharyngeal fat pads and the total volume of upper airway soft tissues. Subjects with sleep apnea and control subjects were exactly matched for sex and ethnicity and frequency matched for age. Covariate adjustments were made for craniofacial size and parapharyngeal fat in the neck, both important determinants of apnea risk (19–22, 26, 27). Thus, in our analyses we report crude odds ratios for the effects of increased size of the soft tissue structures on risk of sleep apnea as well as adjusted odds ratios controlling for the exact matching factors (sex and ethnicity), age, with covariate adjustments for craniofacial size and parapharyngeal neck fat. Some of the results from our study have been previously reported in the form of an abstract (28).

METHODS

Subjects

Control (normal) subjects were recruited through local advertisements in the neighborhood (same school district) of the case subjects (patients with obstructive sleep apnea). Control subjects were of the same sex and ethnic background as the case subjects. To qualify as control subjects, individuals needed to be free of sleep apnea. This was detected in a sleep study and all control subjects were anticipated to have an apnea–hypopnea index (AHI) less than 5 episodes/hour.

Case subjects were recruited primarily from the Penn Center for

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Role of Arousals in the Pathogenesis of Obstructive Sleep Apnea

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Arousal is believed to be needed for upper airway opening in obstructive hypopneas–apneas, without compelling evidence to support this notion. The association may be incidental. I studied the temporal relation between arousal and opening and impact of arousal on flow response at opening in 82 patients (apnea–hypopnea index, 46 ± 35/hour). Obstructive apneas–hypopneas were induced by dial-down of continuous positive airway pressure. Obstructions and hypopneas occurred in 44 and 56% of dial-downs, respectively. When arousal occurred (83% of dial-downs), the temporal relation between arousal and opening was inconsistent between and within patients. Frequency of opening without or before arousal increased with milder obstructions ($p < 10^{-9}$) and with delta power of EEG ($p < 10^{-6}$). Time of opening was unaffected by whether arousal occurred before or after opening (18.0 ± 9.8 vs. 18.1 ± 10.5 seconds). Flow response was already excessive when opening occurred without or before arousal (180 ± 148% of initial flow decline) and was considerably higher when arousal occurred (267 ± 154%, $p < 10^{-10}$). Flow undershoot after first ventilatory response was greater if arousal occurred ($p < 0.01$). It is concluded that arousals are incidental events that occur when thresholds for arousal and for arousal-independent opening are close. They are not needed to initiate opening or to obtain adequate flow and they likely increase the severity of the disorder by promoting greater ventilatory instability.

Keywords: obstructive sleep apnea; mechanisms; ventilatory stability

Arousal from sleep is believed to be an important, if not essential, mechanism for reestablishing airway patency in obstructive sleep apnea (OSA). Originally proposed by Remmers and coworkers (1), this notion was bolstered over the years by the everyday observation that obstructive apneas and hypopneas end abruptly and almost invariably with arousal. The suddenness of increase in flow suggests a discontinuous mechanism, unlike chemical and mechanoreceptor feedback. The concurrent arousal provides a perfect explanation for this discontinuous behavior. This notion is currently so strong that when arousals are not seen at event termination it is presumed that they exist but we failed to detect them.

The preeminence of arousal is based on temporal association between arousal and upper airway (UA) opening. The association may be incidental or even causal in an opposite sense; arousals causing OSA. An incidental association may occur if thresholds for arousal and arousal-independent UA opening are similar. An opposite causal association may result if arousals occur too soon, preempting an orderly compensation by reflex mechanisms. In this case, recurrent cycling (OSA) would occur when arousal threshold is low and would disappear when threshold rises. These alternate possibilities are not without support. (*1*) Some obstructive events terminate without obvious cortical arousal (2–8). These have generally been attributed to insensitive arousal identification criteria, occurrence of arousal in unmonitored cortical areas, or to unconventional presentation of arousal (delta, subcortical, autonomic, etc.) (*see* Berry and Gleeson [4] for review). Perhaps these arousal-free events represent one end of a loose incidental association. (*2*) Patients frequently alternate between recurrent OSA and stable breathing under conditions where such changes cannot be explained by differences in UA collapsibility (9). (*3*) Stable breathing tends to occur in delta sleep, when arousal threshold is high (10–12). (*4*) Progressive recruitment of UA dilators before arousal (i.e., without arousal) is well documented in patients with OSA (1, 3, 13–16) and level of activity may exceed waking levels (3). (*5*) Arousal is triggered when a critical level of chemo/mechanoreceptor input is reached (4, 17–22). Arousal-independent recruitment of UA dilators is sensitive to the same inputs (16, 23–29). Clearly, situations may occur when the input required for triggering arousal and for activating UA muscles enough to open the airway is similar.

In this study, rapid dial-downs of continuous positive airway pressure (CPAP) from a stable baseline were used to induce obstructive apneas–hypopneas in patients with OSA. The role of arousals was examined by: (*1*) documenting the temporal relation between UA opening and arousal. If arousal is required for UA opening, there should be a predictable relation between the two events under different conditions. Conversely, if the relation is incidental, this relation should be variable. (*2*) Comparing the magnitude of increase in flow with and without arousal at UA opening. This would establish whether arousals play a helpful or harmful role. A helpful role may be surmised if flow response without arousal is inadequate. Conversely, an adequate or excessive response without arousal that is further augmented by arousal would suggest a harmful role because an excessive ventilatory response helps perpetuate cycling (30–33). (*3*) Determining whether severity of the next hypopnea is greater if arousal occurred at end of the first hypopnea–apnea. The advantages of dial-downs from CPAP over observations on spontaneous obstructive events are outlined in the online supplement.

This is the second report from this study. Earlier (9), I described the effect of passive abnormalities, as reflected by the lowest flow during dial-downs, on severity of OSA. A preliminary report of the current findings was published (34).

METHODS

A more detailed account of METHODS is given in the online supplement.

Patients, protocol, and general methods are identical to those reported earlier (9). Briefly, 82 patients referred for possible OSA were studied using standard polysomnography. CPAP was titrated after obtaining enough information for clinical evaluation. Flow, airway pressure, and polysomnography signals were recorded. Pressure was dialed-down to 1 cm H_2O during stable sleep. Dial-down was maintained until arousal or 60 seconds. In approximately one third of interventions,

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Sleep Medicine 9 (2008) 727–731

SLEEP MEDICINE

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Original Article

Daytime sleepiness and polysomnography in obstructive sleep apnea patients ☆,☆☆

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Abstract

Background: Excessive daytime sleepiness (EDS) is the major complaint in subjects with obstructive sleep apnea syndrome (OSAS). However, EDS is not universally present in all patients with OSAS. The mechanisms explaining why some patients with OSAS complain of EDS whereas others do not are unknown.
Objective: To investigate polysomnographic determinants of excessive daytime sleepiness (EDS) in a large multicenter cohort of patients with obstructive sleep apnea (OSAS).
Methods: All consecutive patients with an apnea–hypopnea index greater than 5 h^{-1} who were evaluated between 2003 and 2005. EDS was assessed using the Epworth Sleepiness Scale (ESS), and patients were considered to have EDS if the ESS was >10.
Results: A total of 1649 patients with EDS ((mean [±SD] Epworth 15 ± 3) and 1233 without EDS (Epworth 7 ± 3) were studied. Patients with EDS were slightly younger than patients without EDS (51 ± 12 vs 54 ± 13 years, $p < 0.0001$), had longer total sleep time ($p < 0.007$), shorter sleep latency ($p < 0001$), greater sleep efficiency ($p < 0.0001$) and less NREM sleep in stages 1 and 2 ($p < 0.007$) than those without EDS. Furthermore, patients with EDS had slightly higher AHI ($p < 0.005$) and arousal index ($p < 0.001$) and lower nadir oxygen saturation ($p < 0.01$).
Conclusions: Patients with OSAS and EDS are characterized by longer sleep duration and increased slow wave sleep compared to those without EDS. Although patients with EDS showed a mild worsening of respiratory disturbance and sleep fragmentation, these results suggest that sleep apnea and sleep disruption are not the primary determinants of EDS in all of these patients.

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Sleep–Related Breathing Disorders in Adults: Recommendations for Syndrome Definition and Measurement Techniques in Clinical Research

The Report of an American Academy of Sleep Medicine Task Force

1.0 INTRODUCTION

OBSTRUCTIVE SLEEP APNEA is a condition characterized by repetitive obstruction of the upper airway often resulting in oxygen desaturation and arousals from sleep. The classic daytime manifestation is excessive sleepiness but other symptoms such as unrefreshing sleep, poor concentration and fatigue are commonly reported. Over the past thirty years many types of abnormal breathing during sleep have been described that are related to, but not accurately described as apneas. Partial airway obstruction can lead to a reduction in tidal volume, referred to as a hypopnea, with the same consequences as an apnea.[1] Even more subtle abnormalities have been described such as progressive increases in respiratory effort, reflecting increasing upper airway resistance, that terminate after an arousal.[2] Some patients have periods of hypoventilation during sleep, most commonly seen in REM, and not always associated with apneic events. These patients are often obese, usually have awake hypercapnia, and signs of cor pulmonale.[3] Still another type of breathing abnormality consists of those apneic events that are not associated with inspiratory effort, indicating reduced central respiratory drive, referred to as central apneas.[4] Central apneas can occur in otherwise healthy individuals but they are also a feature of Cheyne-Stokes breathing, which is commonly seen in patients with congestive heart failure. Mixed apneas refer to periods of absent airflow that are initially associated with an absence of respiratory effort and that persist upon resumption of respiratory effort indicating upper airway obstruction.

As different types of disordered breathing events during sleep have been described, it has been recognized that signs and symptoms could be used to describe several syndromes. Burwell used the term Pickwickian syndrome to describe patients with obesity, hypercapnia, cor pulmonale, erythrocytosis, and daytime hypersomnolence.[3] Guilleminault introduced the term *obstructive sleep apnea syndrome* (OSAS) with its central feature of daytime hypersomnolence and polysomnographically proven obstructive apneas.[5] *Hypopneas* were first described by Block, et al. as events of shallow breathing causing oxygen desaturation.[6] In 1988, cases with hypopneas and no or few apneas were described, with clinical symptoms similar to OSAS, and introduced the sleep hypopnea syndrome.[1] Subsequently the OSAS began to be referred to as the *obstructive sleep apnea-hypopnea syndrome* (OSAHS). In 1992 Guilleminault described a series of patients that had typical symptoms of obstructive sleep apnea but who did not have obstructive apneas or hypopneas on polysomnography. It was suggested that these events, characterized by increasing negative esophageal pressure during inspiration and terminating with an arousal, reflected an *upper airways resistance syndrome* (UARS).[2] The term *central sleep apnea syndrome* (CSAS) has also been discussed in the literature but it has never been established whether patients with Cheyne-Stokes breathing or those with high altitude periodic breathing should be included under this rubric.

The initial description of OSAS by Guilleminault included a criterion of a minimum duration of 10 seconds for an apnea to be scored. Based on a study of healthy subjects it was also suggested that more than 30 apneas per night should be considered abnormal.[5] This was later standardized as the apnea index, which reflects the number of apneas per hour of sleep. The apnea index cutoff for OSAS was set at 5.[7] Since the initial descriptions of these different types of abnormal breathing events and their related syndromes, technology has changed and original definitions have been modified to incorporate methods with uncertain validity and reliability. This has led to variable definitions of events and syndromes that are based on differing methodologies. The lack of uniform definitions as well as the clinical overlap between the Pickwickian syndrome, OSAHS, and CSAS has created confusion in clinical settings and has hindered comparisons of results from research studies. This publication addresses this issue by proposing a set of standard criteria for defining apnea events and syndromes.

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Comments and Reprint Requests to: AASM in conjunction with: The European Respiratory Society, The Australasian Sleep Association, The American Thoracic Society

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ORIGINAL ARTICLE

An international survey of sleeping problems in the general population

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Key words: Multinational – Prevalence – Sleep disorders – Survey – Treatment

ABSTRACT

Objective: This international omnibus survey investigated the prevalence and characteristics of sleep problems, as well as strategies for resolving sleep problems, in the general population of the USA, France, Germany, Italy, Spain, the UK and Japan.

Research design and methods: A representative sample of the general population aged ≥15 years was recruited from each country. Questions focused on the nature of sleeping problems, the impact of problems on daily functioning and behavior with regard to resolving sleeping problems.

Results: A total of 10 132 individuals were included in this survey. The prevalence of sleeping problems was 56% in the USA, 31% in Western Europe and 23% in Japan. Most individuals with sleeping problems considered these to have an impact on their daily functioning, with family life most affected in the Western European sample, personal activities in the US sample and professional activities in the Japanese sample. Almost half of individuals with sleep problems had never taken any steps to resolving them, and the majority of respondents had not spoken with a physician about their problems. Of those individuals who had consulted a physician, drug prescriptions had been given to approximately 50% in Western Europe and the USA and 90% in Japan.

Conclusions: Sleeping problems continue to present a considerable burden across Western Europe, the USA and Japan. Despite this, they are under-reported and under-treated, with almost half of affected individuals not taking any steps to resolve their sleeping problems.

Introduction

Insomnia can be defined as difficulty falling asleep, difficulty maintaining sleep, early-morning awakening and non-restorative sleep with associated daytime consequences[1–4]. However, the wide range of distinctive etiologies and varying degrees of sleep disturbance often make classification difficult. Depending on definition and regions, up to one-third of the population may experience insomnia symptoms[5–13]. For example, on a large cross-sectional telephone survey conducted in a representative sample of the populations of France, the UK, Germany, Italy, Portugal and Spain, difficulty initiating or maintaining sleep for at least three nights

Paper 3615

14. Kawaguchi Y, Fukumoto S, Inaba M, et al., Different impacts of neck circumference and visceral obesity on the severity of obstructive sleep apnea syndrome. Obesity. 2011; 19 (2):276-282.

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Different Impacts of Neck Circumference and Visceral Obesity on the Severity of Obstructive Sleep Apnea Syndrome

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Our aim was to investigate the significance of neck circumference (NC) on the presence and severity of obstructive sleep apnea (OSA) syndrome independent of visceral fat (VF) obesity. A total of 219 subjects with suspected OSA underwent a complete polysomnography (PSG) study, along with the measurement of NC, and total body fat (TF) and VF levels (VFLs) measured by bioelectrical impedance analysis. We proposed NC divided by height (NC/*H*) as the simple index for height-corrected NC in Japanese subjects. NC/*H* exhibited a significantly stronger correlation than NC *per se* with BMI ($r = 0.781$ vs. 0.675, $P = 0.0178$), TF ($r = 0.531$ vs. 0.156, $P < 0.0001$), and VF ($r = 0.819$ vs. 0.731, $P = 0.0203$), indicating that NC/*H* is a better indicator of visceral obesity than NC *per se*. Interestingly, despite the strong correlation between NC/*H* and VFL, VFL was significantly associated with the apnea–hypopnea index (AHI) ≥5, ≥15, and ≥30, but not with ≥40 or ≥50, whereas NC/*H* was significantly associated with higher AHI values, i.e., AHI ≥50 but not with lower AHI value. Furthermore, multiple regression analyses revealed that VFL and NC/H were independently associated with the square root of AHI ($AHI^{0.5}$) levels in obese and nonobese patients, respectively. In conclusion, NC is associated with the severity of OSA independently of visceral obesity, especially in nonobese patients.

Obesity (2011) **19**, 276–282. doi:10.1038/oby.2010.170

INTRODUCTION

Obstructive sleep apnea (OSA), which is characterized by repeated pharyngeal collapse during sleep, is associated with excessive daytime sleepiness, resulting in decline in the patient's quality of life (1) and may affect his/her performance in tasks requiring sustained vigilance (2). Moreover, OSA is also known to be associated with the metabolic syndrome (MetS) (3,4), particularly insulin resistance (5,6), the development of type 2 diabetes independent of adiposity (7,8), and cardiovascular mortality (9,10).

Obesity is a major risk factor for OSA and has been also reported to be directly associated with the severity of OSA (11). However, a large epidemiological study revealed that ~60% of OSA patients were not obese (12). In particular, most of the far-east Asian men with OSA were reported to be nonobese (13,14). Moreover, far-east Asian patients were also reported to be less obese than their white counterparts, but with more severe OSA. Craniofacial and upper airway abnormalities are established risk factors for OSA (3). Li *et al.* suggested that the difference in the severity of OSA between the two races could be attributed to the differences in the craniofacial anatomy in the two races (14). Sakakibara *et al.* also reported that upper airway soft tissue enlargement might play a more important role in the pathogenesis of OSA in obese patients, while cephalometric abnormalities of bony structure might be the predominant risk factors in nonobese Japanese patients (13).

Thickness of the neck is suggested as another physical factor contributing to the pathogenesis of OSA. Recently, it was indicated that neck circumference (NC) is a useful predictor of OSA, and the variance in the severity of OSA explicable by central obesity depends on the variation in the NC (15,16). However, the direct role of NC in the development of OSA has not been fully clarified yet, because of the correlation of NC itself with obesity, especially with the visceral fat level (VFL) (11). NC corrected for height is reported to be more effective to investigate the impact of NC on OSA development than NC *per se* as the height dependence of NC (17,18), and the former may be up to 77% sensitive and 82% specific for detecting OSA in patients referred to sleep clinics (19). Although the reported formula for the measurement of height-corrected NC is generated using the data obtained for British subjects, a formula of height-corrected NC for Japanese subjects has not been reported yet.

In this study, we first proposed that NC divided by height (NC/*H*) is the simple index for height-corrected NC in

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Original Contribution

Increased Prevalence of Sleep-Disordered Breathing in Adults

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Sleep-disordered breathing is a common disorder with a range of harmful sequelae. Obesity is a strong causal factor for sleep-disordered breathing, and because of the ongoing obesity epidemic, previous estimates of sleep-disordered breathing prevalence require updating. We estimated the prevalence of sleep-disordered breathing in the United States for the periods of 1988–1994 and 2007–2010 using data from the Wisconsin Sleep Cohort Study, an ongoing community-based study that was established in 1988 with participants randomly selected from an employed population of Wisconsin adults. A total of 1,520 participants who were 30–70 years of age had baseline polysomnography studies to assess the presence of sleep-disordered breathing. Participants were invited for repeat studies at 4-year intervals. The prevalence of sleep-disordered breathing was modeled as a function of age, sex, and body mass index, and estimates were extrapolated to US body mass index distributions estimated using data from the National Health and Nutrition Examination Survey. The current prevalence estimates of moderate to severe sleep-disordered breathing (apnea-hypopnea index, measured as events/hour, ≥15) are 10% (95% confidence interval (CI): 7, 12) among 30–49-year-old men; 17% (95% CI: 15, 21) among 50–70-year-old men; 3% (95% CI: 2, 4) among 30–49-year-old women; and 9% (95% CI: 7, 11) among 50–70 year-old women. These estimated prevalence rates represent substantial increases over the last 2 decades (relative increases of between 14% and 55% depending on the subgroup).

adult; middle age; obesity; sleep

Abbreviations: AHI, apnea-hypopnea index; BMI, body mass index; NHANES, National Health and Nutrition Examination Survey; SDB, sleep-disordered breathing.

The apnea and hypopnea events of sleep-disordered breathing (SDB) have substantial harmful health consequences. Immediate effects include intermittent hypoxia, fragmented sleep, and exaggerated fluctuations in heart rhythm, blood pressure, and intrathoracic pressure (1). In turn, these acute physiologic disruptions evolve into long-term sequelae, such as hypertension and cardiovascular morbidities (1–3), decrements in cognitive function (4, 5), mood and quality of life (6, 7), and premature death (8, 9).

In 1993, data collected over a 4-year period from the Wisconsin Sleep Cohort Study uncovered a high prevalence of SDB assessed using polysomnography in a working population–based sample of adults 30–60 years of age (10). The findings were corroborated by other US population-based studies (11), but these prevalence rates were estimated more than a decade ago (12, 13). The most important modifiable causes of SDB in adult populations are overweight and obesity. Weight gain and loss have been consistently associated with increasing and decreasing SDB severity, respectively, in observational and intervention studies (14–16). Over the last few decades, the prevalence rates of overweight and obesity experienced epidemic trajectories in the United States (17–20), which is likely to have resulted in increased occurrence of obesity-related outcomes, including SDB.

In the United States, a systematic program for monitoring SDB prevalence over time does not exist. High-quality objective assessments of SDB are time-consuming, expensive, and burdensome to subjects, typically requiring overnight continuous monitoring of multiple physiologic processes,

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Clinical Predictors of Obstructive Sleep Apnea

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Objective: **To identify physical findings that can be standardized to predict the presence and the severity of obstructive sleep apnea (OSA).** ***Study Design:*** **One hundred seventy-two patients who answered questionnaires with responses that suggested they might have OSA were included in this prospective study.** ***Methods:*** **All patients underwent a physical examination and polysomnography. The physical examination included the measurement of four parameters used by anesthesiologists to identify patients likely to have difficult intubation to determine if these same parameters predict OSA. We recorded modified Mallampati grade (MMP), tonsil size, and body mass index (BMI) and measured thyroid-mental distance (TMD) and hyoid-mental distance (HMD) in the study population.** ***Results:*** **When the physical findings were correlated singly with the respiratory disturbance index (RDI), we found that MMP ($P < .001$), tonsil size grading ($P = .008$), and BMI ($P = .003$) were reliable predictors of OSA. A greater correlation with OSA emerged when an "OSA score" was formulated by factoring the MMP, tonsil grade, and BMI grade (RDI = 7.816 × MMP + 3.988 × Tonsil Size + 4.675 × BMI − 7.544). A high score was not only predictive of OSA but also correlated well with OSA severity. Neither HMD nor TMD correlated with the severity of RDI.** ***Conclusions:*** **An OSA score may help identify those patients who should have a full sleep evaluation.** ***Key Words:*** **Obstructive sleep apnea, physical examination, prediction.**

Laryngoscope, **109:1901–1907, 1999**

INTRODUCTION

Obstructive sleep apnea (OSA) is a fairly common condition, affecting 24% of male and 9% of female middle-aged adults.[1] Currently the condition is diagnosed through history, physical examination, imaging studies, and polysomnography.[2] Common symptoms of the condition have limited predictive value in identifying patients with OSA.[3–5] The upper airway is the main anatomical site responsible for OSA. Clinical examination may point to severe retrognathia, hypertrophic tonsils, macroglossia and redundant pillars, elongated uvula, and a crowded oropharynx.[6,7] There is no standard way to describe or quantify abnormality of these structures when OSA is suspected. Endoscopic investigations have been performed in awake as well as in sleeping patients, with the pharynx in relaxed or active states; but their predictive value remains limited, both for diagnostic purposes and for identifying patients who may benefit from surgery.[8,9] Despite the large volume of literature on OSA, there is a lack of consensus in describing physical findings associated with OSA. Internists, neurologists, pulmonologists, and sleep specialists, although commonly involved in diagnosing OSA patients, do not possess the experience required to assess the upper airway. The otolaryngologist has the unique opportunity to examine the palate, pharynx, and neck of the patient and suspect OSA when appropriate. Although numerous reports on OSA have addressed symptoms reported by the patient, lab findings, and polysomnography results,[3,7,10,11] a gap currently exists in identifying reproducible physical findings. Radiographic and magnetic resonance imaging techniques have also permitted a detailed understanding of the process of the narrowing and collapse of the upper airways.[12] Unfortunately, these techniques are no better than the ones previously cited as clinically efficient tools for formulating the diagnosis of sleep-related breathing disorders.

Diagnosis of a disease is based on clinical symptoms and physical findings and is corroborated by laboratory examinations. Polysomnography remains the standard in the diagnosis of sleep-related breathing disorders. Precise physical findings associated with OSA have not been clearly established yet, except for body mass index (BMI).[13,14] A need exists for accurate diagnostic physical findings that predict OSA. It seems essential to first identify anatomic abnormalities associated with a disease before surgical intervention. The need for accurate, quantitative diagnostic criteria is further supported by the significant cost incurred with routine polysomnography.[5,15]

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A clinical sign to predict difficult tracheal intubation: a prospective study

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It has been suggested that the size of the base of the tongue is an important factor determining the degree of difficulty of direct laryngoscopy. A relatively simple grading system which involves preoperative ability to visualize the faucial pillars, soft palate and base of uvula was designed as a means of predicting the degree of difficulty in laryngeal exposure. The system was evaluated in 210 patients. The degree of difficulty in visualizing these three structures was an accurate predictor of difficulty with direct laryngoscopy ($p < 0.001$).

Key words
INTUBATION, ENDOTRACHEAL: complications, difficult intubation; ANAESTHETIC TECHNIQUES: laryngoscopy.

Unexpected difficulties in endotracheal intubation can be a significant aetiologic factor in morbidity and mortality in clinical practice. However, it is not always possible to predict from usual clinical observations in which patient orotracheal intubation may prove difficult. This is particularly true in individuals who offer significant difficulty for orotracheal intubation despite unremarkable orofacial anatomic features.

The principal author of this paper (S.R.M.) previously proposed a "clinical sign to predict difficult tracheal intubation (hypothesis)."[1] The clinical sign is the concealment of faucial pillars (palatoglossal and palatopharyngeal arches) and uvula by the base (posterior part) of the tongue, when the latter is maximally protruded in a seated patient. The anatomic basis of the sign is explained by the hypothesis as follows. If the base of the tongue is disproportionately large, it overshadows the larynx, rendering the exposure of the latter by direct laryngoscopy poor or difficult. A large tongue is also likely to mask the visibility of the faucial pillars and the posterior part of the soft palate where the uvula is an easily recognizable landmark. Since it is not possible to determine the volume or size of the base of tongue relative to the capacity of the oropharyngeal cavity, it is also logical to infer that the base of the tongue is disproportionately large when it is able to mask the visibility of the faucial pillars and uvula.

This clinical sign was evaluated in a prospective study which was designed and conducted to ascertain the sign's usefulness in predicting the ease or difficulty of orothacheal intubation in clinical practice.

Methods

The study was approved by the "Human Subjects for Research Studies Committee" of our institution.

Two hundred and ten adult surgical patients (47 men and 163 women; Table I), American Society of Anesthesiologists (ASA) physical status 1 or 2, who required general endotracheal anaesthesia were included in the study. One hundred and ninety nine patients had full dentition. Three patients had no maxillary teeth. Eight patients were edentulous. Twelve patients had prominent maxillary incisors resulting in "overbite." Patients were chosen consecutively with few criteria for exclusion. All patients were in good general health. Patients with known cardiovascular or respiratory pathology were excluded.

Patients who were known to have any form of

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Frequency of Parent-reported Indicators of Sleep Disordered Breathing in Children with Clinical Diagnosis of Adenotonsillar Hypertrophy in Benin City, Nigeria

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Abstract

Background: Sleep disordered breathing (SDB) comprises a wide spectrum of sleep-associated breathing abnormalities; those related to increase upper airway resistance include snoring, upper airway resistance syndrome (UARS) and obstructive sleep apnea syndrome (OSAS). This concept suggests that a person who snores may be exhibiting the first manifestation of SDB and that snoring should not be viewed as normal. Obstructive sleep disordered breathing is common in children. Snoring, mouth breathing, and obstructive sleep apnea (OSA) often prompt parents to seek medical attention.

Aim: This study aims to determine the frequency of parent-reported indicators of SDB among children clinically diagnosed with adenotonsilar hypertrophy (ATH) in the Otorhinolaryngology department of the University of Benin Teaching Hospital (UBTH), Benin City.

Methods: This was a cross-sectional study of children aged 12 years and below who were sent to the Ear Nose and Throat clinics of UBTH, Benin-city with symptoms of obstructive adenotonsilar hypertrophy (ATH) between May 2012 and April 2014. All consecutive parent/caregiver who presented their child/ward to the ENT clinic with symptoms of obstructive adenotonsilar hypertrophy (ATH) were interviewed using structured questionnaire/proforma after verbal consent was obtained.

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Control de las vías respiratorias en anestesiología

A.-M. Cros ✉

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La anestesia causa obstrucción de las vías respiratorias superiores (VRS) debido a que genera una hipotonía responsable del desplazamiento posterior de las estructuras faríngeas. La obstrucción se produce a nivel de la nasofaringe y la epiglotis y, en menor grado, en la base de la lengua. La extensión de la cabeza, la protrusión mandibular y la elevación del mentón permiten hacerla desaparecer. La permeabilidad de las VRS se puede conseguir mediante dispositivos supralaríngeos o por intubación. Los adelantos relativos al material tienden hacia el uso único. Los dispositivos supralaríngeos provistos de un tubo de drenaje brindarían mayor seguridad. El problema principal de estos dispositivos es el riesgo de aspiración, que puede reducirse con una anestesia estable profunda y con presiones inspiratorias inferiores a la presión de fuga. Las reglas de buenas prácticas sobre la

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The cephalometric morphology of patients with obstructive sleep apnoea (OSA)

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SUMMARY This prospective study analysed the lateral cephalometric radiographs of 59 dentate, white, Caucasian males. Thirty-five patients with proven obstructive sleep apnoea (OSA) formed the experimental group, while 24 subjects with no history of respiratory disease acted as controls. Radiographs were traced and digitized, and both hard and soft tissue features were compared between the groups. The pooled data were then subjected to discriminate analysis.

Although conventional cephalometric measurements did not differ between the two groups, significant reductions were found in the lengths of the mandibular body and cranial base and in cranial base angulation in OSA subjects. The width of the oropharynx was significantly narrower in this group, particularly in the post-palatal region. The area of the soft palate was increased although that of the tongue was not. Intermaxillary space length (the distance between the posterior pharyngeal wall and the tip of the lower incisor) was decreased, and thus the area in which the tongue had to function was smaller in OSA subjects.

From the discriminant analysis, two four-variable models were derived, both of which provided 100 per cent discrimination between the OSA and normal subjects. For the first model the entire OSA group was used: for the second, only obese OSA subjects (those a body mass index >25) were chosen.

The combination of a short mandible and intermaxillary space, with an enlarged soft palate but decreased pharyngeal airway has relevance to the effective management of OSA. In selected patients, advancement of the lower jaw by a nocturnal mandibular repositioning splint may be indicated. The orthodontist would seem to be in a unique position to assist in both the identification and treatment of these subjects.

Introduction

Obstructive sleep apnoea (OSA) is a potentially life-threatening condition in which periodic cessation of breathing occurs during sleep in the presence of inspiratory effort. This affects not only the quality of life but also has a significant morbidity. The reduction in blood oxygen saturation may give rise to hypertension, cardiac arrhythmias, nocturnal angina and myocardial ischaemia (Klitzman and Miller, 1994; Rapoport, 1994). Impaired sleep quality leads to reduced concentration and the risk of falling asleep during the day.

The aetiology of this condition would appear to be a blend of anatomical and pathophysiological features (Anch *et al.*, 1982; Haponik *et al.*, 1983; Rivlin *et al.*, 1984; Lowe *et al.*, 1986a; Rodenstein *et al.*, 1990). During sleep, the combination of a reduction in lingual and pharyngeal muscle tone, alterations in breathing control, the supine position and reduced pharyngeal space may lead to airway occlusion in susceptible subjects.

Lateral cephalometric radiographs have been used by several investigators in an attempt to identify morphological parameters that might be characteristic of OSA. However, their value as a routine diagnostic tool is uncertain, as a true assessment of the airway dimensions requires a three-dimensional recording technique such as computerized tomography (CT) scanning or

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Original Article

Maxillary Morphology in Obstructive Sleep Apnea: A Cephalometric and Model Study

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Abstract: The relationship between maxillary constriction and the etiology of obstructive sleep apnea (OSA) is not clear. This prospective case-control study compared maxillary morphology in 94 dentate subjects (47 OSA and 47 control subjects), using upright lateral cephalograms and study models. Each subject had height, weight, and neck circumference measurements recorded and underwent an orthodontic examination. An upright lateral cephalogram and dental impressions were obtained. All data were analyzed using the SPSS statistical package applying nonparametric tests at the 5% level of significance. Male and female subjects were examined separately, and statistically significant differences were found between the cephalometric measurements for OSA and the control subjects. The palatal angle was more obtuse in male OSA subjects ($P < .05$). The PNS-posterior pharyngeal wall was shorter ($P < .05$) and the soft palate longer in female OSA subjects ($P < .05$). Minimum palatal airway widths were significantly reduced in both male ($P < .01$) and female ($P < .001$) subjects. In the comparison of study model measurements, palatal heights in OSA subjects were greater ($P < .05$). Thus, maxillary morphological differences do exist between OSA and control subjects, supporting their role as a etiological factor. (*Angle Orthod* 2004; 74:648–656.)

Key Words: Obstructive sleep apnea; Etiology; Maxilla

INTRODUCTION

Obstructive sleep apnea (OSA) is a potentially life-threatening disorder, estimated to affect 3.9% of men and 1.2% of women.[1] OSA is diagnosed using a combination of a sleep history, supporting questionnaires, a clinical examination of the upper airway, and overnight sleep monitoring. Snoring and excessive daytime sleepiness are the most common presenting complaints. The Epworth sleepiness scale (ESS) questionnaire elicits the likelihood of falling asleep in eight different situations.[2] Overnight polysomnography is considered the "gold standard" for the diagnosis of OSA.

Guilleminault et al[3] studied the relationship between maxillary constriction and the etiology of OSA and reported a familial tendency of narrow, high palates in the relatives of OSA patients. Cistulli and Sullivan[4] have shown a high prevalence of OSA among patients with Marfan's syndrome.

Continuous positive nasal airway pressure has traditionally been the choice of treatment for moderate to severe OSA.[5] Mandibular advancement splints are used in the management of subjects with mild to moderate OSA.[6] Recently, the use of rapid maxillary expansion (RME) as a treatment modality for OSA has been put forward.[6,7]

RME increases the width of the maxilla, reduces nasal resistance,[7] and increases the intranasal capacity. Hershey et al[8] reported a 45–55% reduction in nasal airway resistance, which was maintained after removal of the appliance. Wertz[9] concluded that RME cannot be justified for the purposes of increased nasal permeability unless there is a relative maxillary arch width deficiency and the obstruction lies in the lower portion of the nasal cavity. Cistulli et al[10] investigated the effect of RME as a treatment in six young adults who underwent RME and elective surgical assistance and in four who were treated with RME alone. In seven cases, the apnea-hypopnea index (AHI) was reduced to normal values, and the authors attributed this to an improvement in nasal airflow, tongue posture, and soft palate function.

The role of the maxilla in the etiology of OSA is not well described, and this deficiency needs to be addressed to develop evidence-based practice. The aims of this study were to evaluate the role of the maxilla in the etiology of OSA and to determine any differences between sexes.

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An American Sleep Disorders Association Report

Practice Parameters for the Indications for Polysomnography and Related Procedures

Indications for Polysomnography Task Force,
American Sleep Disorders Association Standards of Practice Committee

Summary: These clinical guidelines, which have been reviewed and approved by the Board of Directors of the American Sleep Disorders Association, provide recommendations for the practice of sleep medicine in North America regarding the indications for polysomnography in the diagnosis of sleep disorders. Diagnostic categories that are considered include the following: sleep-related breathing disorders; neuromuscular disorders and sleep-related symptoms; chronic lung disease; narcolepsy; parasomnias; sleep-related epilepsy; restless legs syndrome; periodic limb movement disorder; depression with insomnia; and circadian rhythm sleep disorders. Whenever possible, conclusions are based on evidence from review of the literature. Where scientific data are absent, insufficient, or inconclusive, recommendations are based on consensus of opinion. The Standards of Practice Committee of the American Sleep Disorders Association appointed a task force to review the topic, the indications for polysomnography and related procedures. Based on the review and on consultation with specialists, the subsequent recommendations were developed by the Standards of Practice Committee and approved by the Board of Directors of the American Sleep Disorders Association. Polysomnography is routinely indicated for the diagnosis of sleep-related breathing disorders; for continuous positive airway pressure (CPAP) titration in patients with sleep-related breathing disorders; for documenting the presence of obstructive sleep apnea in patients prior to laser-assisted uvulopalatopharyngoplasty; for the assessment of treatment results in some cases; with a multiple sleep latency test in the evaluation of suspected narcolepsy; in evaluating sleep-related behaviors that are violent or otherwise potentially injurious to the patient or others; and in certain atypical or unusual parasomnias. Polysomnography may be indicated in patients with neuromuscular disorders and sleep-related symptoms; to assist in with the diagnosis of paroxysmal arousals or other sleep disruptions thought to be seizure-related; in a presumed parasomnia or sleep-related epilepsy that does not respond to conventional therapy; or when there is a strong clinical suspicion of periodic limb movement disorder. Polysomnography is not routinely indicated to diagnose chronic lung disease; in cases of typical, uncomplicated, and noninjurious parasomnias when the diagnosis is clearly delineated; for patients with epilepsy who have no specific complaints consistent with a sleep disorder; to diagnose or treat restless legs syndrome; for the diagnosis of circadian rhythm sleep disorders; or to establish a diagnosis of depression. **Key Words:** Practice parameters—Practice guidelines—Standards of practice—Polysomnography—Sleep apnea syndrome—Sleep disorders—Narcolepsy—Parasomnias—Restless legs syndrome—Periodic limb movement disorder—Insomnia—Circadian rhythm disorders.

1.0 INTRODUCTION

According to the National Commission on Sleep Disorders Research, sleep disorders affect approximately 40 million people in the United States (1). Sleep disorders can cause daytime sleepiness, lead to a decreased quality of life, and impose a medical risk to patients, thereby resulting in increased expenditure of health care dollars. The accurate diagnosis of sleep disorders is therefore of paramount importance from social and economic standpoints. When performed injudiciously, however, sleep testing procedures may lead to unnecessary increases in health care cost.

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Although remarkable strides have been made since the 1970s in diagnosing sleep disorders by polysomnographic evaluation, guidelines for the most appropriate and cost-effective use of sleep testing procedures have not always been clear or consistent. What began as limited electroencephalographic measurements during sleep has evolved into a variety of sleep medicine procedures. These procedures typically involve the measurement of multiple channels of physiologic parameters, including—but not limited to—electroencephalography (EEG), electro-oculography (EOG), electromyography (EMG), electrocardiography (ECG) or heart rate, respiratory effort, air flow, and oxygen saturation. Additional recording channels

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Preliminary Communication

The Effects of a Nonsurgical Treatment for Obstructive Sleep Apnea

The Tongue-Retaining Device

Rosalind D. Cartwright, PhD, Charles F. Samelson, MD

• **The tongue-retaining device (TRD) was designed to increase the unobstructed dimension of the nasal breathing passage during sleep. Twenty male patients with diagnoses of sleep apnea syndrome, primarily of the obstructive type, confirmed by clinical polysomnography, were fitted with the device. The TRD holds the tongue in a forward position by negative pressure. Fourteen patients have been tested before and after this treatment, and ten of these have also completed two follow-up recordings four to six months after being trained in the use of this device. There was significantly improved sleep and significantly fewer and shorter apneic events on all nights when the device was worn. On the first night of wearing the TRD for a half night only, there was a significant reduction in the number of obstructive and central apneic episodes. The mean apnea plus hypopnea index while wearing the TRD is comparable with the rate reported for patients who have been treated surgically by either tracheostomy or by uvulopalatopharyngoplasty, although the tracheostomy group contained more severe cases.**

(*JAMA* 1982;248:705-709)

SLEEP APNEA syndrome is a potentially life-threatening disorder, the incidence of which is, at present, unknown. Current published estimates of 50,000 in the United States[1] are now acknowledged to be a vast underestimate. More likely, the incidence is in the range of a half million to 1 million or even greater. After its initial description by Gastaut et al,[2] this disorder received sparse attention until recently, when the pathogenesis and differential treatment of the various types became a focus of work.[3-7] Sleep apnea of the obstructive type is the most common. This is secondary to a sleep-induced airway obstruction in the presence of continued respiratory effort. Although there is still debate about the role of active sphincturelike closure *v* a passive collapse of the pharyngeal walls, the criterion accepted for diagnosis of this disorder is a cessation of airflow at the level of the nose and mouth at least 10 s in duration, occurring more than 30 times in a seven-hour sleep period.

All evidence is that obstructive sleep apnea is more common in men (82% to 95% of cases)[8] and that it is most often identified first in midlife with the development of loud snoring and excessive daytime sleepiness. It is frequently accompanied by obesity and hypertension.

Until recently, the analysis of the effectiveness of various treatments had established that a permanent tracheostomy is the preferred treatment when obstructive sleep apnea is severe. In their series of 30 patients, Lugaresi et al[9] showed that weight loss and drug treatments produced only small and fluctuating improvements, while those refusing treatment were most often unchanged or worse. Of the four deaths in this series, three were due to respiratory coma and one to a myocardial infarction. One of the three deaths from respiratory coma followed the refusal of a tracheostomy patient to maintain an open stoma. Another patient who had successful surgery had first refused a tracheostomy, which was then performed as an emergency when the patient was brought into the hospital in a respiratory coma.

On another series of 30 male patients, Guilleminault and Dement[10] reported that for 12 men who were treated with dietary restrictions, only one's condition showed some improvement. Fourteen were treated with aminophylline or progesterone, of which the conditions of nine improved. One had an adenoidectomy and partial resection of the soft palate, which was followed by a reduction in the number of sleep-induced apneic episodes and a major reduction of cardiac arrhythmias. Of the nine who were given tracheostomies, all had dramatic reversals of symptoms. Another five refused tracheostomies, three of whom died. Two of these deaths appeared to be due to hypoxemia during sleep.

Weitzman et al[11] described ten patients for whom tracheostomy was

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Genioglossus muscle activity and inspiratory timing in obstructive sleep apnea

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Atypical tongue muscle activity during sleep may contribute to the development of obstructive sleep apnea (OSA). Inspiratory genioglossus (GG) muscle activity was investigated in 10 OSA adults and 4 symptom-free controls. On the basis of overnight monitoring during nonREM sleep, the duration of the inspiratory GG activity and the total GG activity cycle is shorter in patients with OSA. The duration of inspiration and the duration of one total respiratory cycle is also shorter in patients with OSA. The commencement time lag between inspiratory GG activity and the onset of inspiration is shorter in patients with OSA during nonapneic breathing which indicates that inspiratory GG activity is activated relatively later in these patients. Furthermore, the inspiratory GG activity occurs after inspiration during an apnea, but the timing of GG activity onset progressively advances during the apnea. Earlier GG reactivation occurs before inspiration during the first nonoccluded breath at the end of an apnea. During subsequent tidal breathing, the timing of the GG onset progressively decreases after the onset of inspiration until the next obstructive apnea occurs. This observation suggests that the timing relationship between GG inspiratory activity and inspiratory effort is of physiologic importance in the pathogenesis of OSA. Furthermore, it may explain why dental appliances, such as the tongue retaining device, are highly effective in the resolution of OSA in selected patients. (Am J Orthod Dentofac Orthop 1993;104:138-45.)

Obstructive sleep apnea (OSA) is characterized by recurrent upper airway occlusion during inspiration.[1-7] The genioglossus (GG) muscle is believed to contribute to this occlusion. The role of the GG muscle in the resolution of OSA has been investigated at length.[8-10] Genioglossus muscle activity has been demonstrated in phase with inspiration during sleep.[8] Preferential activation of this muscle is correlated with pharyngeal opening and the resolution of the apnea.[9,10] A dynamic relationship between supraglottic pressure and GG muscle amplitude has been postulated to explain the upper airway occlusion in subjects with OSA.[9] However, the phasic time relationship between GG muscle activity and respiration during sleep has not been investigated in human subjects. The coordination of inspiratory GG muscle activity with inspiratory effort has been proposed as an important factor during sleep since the patency of upper airway is in part maintained by the GG muscle. The onset of the GG activity has been shown to be earlier in response to increased negative pressure in the upper airway in dogs.[11] It is not known whether the timing of GG muscle activity is abnormal in patients with OSA. The purpose of this study is to evaluate inspiratory GG muscle activity and its phasic interaction with inspiration in OSA patients and in control subjects.

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METHODS

Ten adult patients with moderate to severe OSA and four symptom-free control subjects were evaluated. Demographic data for the OSA patients and control subjects are provided in Table I. All subjects were men ranging in age from 32 to 71 years. The body mass index ranged between 25.61 to 45.17 kg/m_2 for patients with OSA and between 22.44 to 32.18 kg/m_2 for control subjects. Patients with OSA were selected on the basis of an initial diagnostic overnight polysomnogram. Apnea indices ranged from 17.50 to 52.00 apneas per hour, and the total apnea time varied from 13.11% to 45.03%. Intraoral bipolar surface electrodes for the GG muscle were fitted for each subject. The electrodes consisted of two silver balls (W100 Unitek Ltd., USA) of 5 mm diameter separated by a 20 mm distance. They were positioned on the inner lower surface of a rubber base impression (Reprosil, Dentsply Ltd., Surrey, England) registered on the lingual surface of

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CHEST Postgraduate Education Corner

CONTEMPORARY REVIEWS IN SLEEP MEDICINE

Dental Appliance Treatment for Obstructive Sleep Apnea*

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Oral appliances for the treatment of obstructive sleep apnea (OSA) are worn during sleep to maintain the patency of the upper airway by increasing its dimensions and reducing its collapsibility. Oral appliances are a simpler alternative to continuous positive airway pressure (CPAP). Over the last decade, there has been a significant expansion of the evidence base to support the use of oral appliances, with robust studies demonstrating their efficacy. This work has been underpinned by the recognition of the importance of upper airway anatomy in the pathophysiology of OSA. The updated practice parameters of the American Academy of Sleep Medicine now recommend their use for mild-to-moderate OSA, or for patients with severe OSA who are unable to tolerate CPAP or refuse treatment with CPAP. Oral appliances have been shown to have a beneficial impact on a number of important clinical end points, including the polysomnographic indexes of OSA, subjective and objective measures of sleepiness, BP, aspects of neuropsychological functioning, and quality of life. Elucidation of the mechanism of action of oral appliances has provided insight into the factors that predict treatment response and may improve the selection of patients for this treatment modality. Longitudinal studies to characterize the long-term adverse effects of oral appliance use are now beginning to emerge. Although less efficacious than CPAP for improving the polysomnographic indexes of OSA, oral appliances are generally preferred by patients. This has the potential to translate to better patient adherence and may provide an equivalent health outcome. ***(CHEST 2007; 132:693–699)***

Key words: mandibular advancement splints; obstructive sleep apnea; oral appliances; sleep apnea syndrome

Abbreviations: AHI = apnea-hypopnea index; CPAP = continuous positive airway pressure; OSA = obstructive sleep apnea; TRD = tongue-retaining device

The obstructive sleep apnea (OSA) syndrome is a common condition that is associated with serious adverse health consequences.[1] Since the first description of this disorder in the medical literature in 1965,[2] effective treatments that modify these health risks have emerged.[3] Although continuous positive airway pressure (CPAP) is the most efficacious treatment,[4] it requires the use of a mask interface, sealed tubing, and a device connected to a power source. This complexity limits its acceptance by patients and leads to suboptimal treatment adherence.[5–7]

Oral appliances are a simpler alternative to CPAP for the treatment of OSA.[8] They are often considered by patients to be a more acceptable treatment modality compared to CPAP,[9] as they are quiet, portable, and do not require a power source. While the role of oral appliances for the treatment of OSA was unclear in the past, this has changed substantially in the last decade. There is now an increasing evidence base to support the use of oral appliances in

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Sleep apnea and mandibular advancement device. Revision of the literature

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Abstract

Sleep apnea and hypopnea syndrome (SAHS) is a disorder characterized by intermittent and repetitive obstruction of the upper airway provoking pharyngeal collapse. It is characterized clinically by a triad of daytime hypersomnia, snoring and pauses in breathing during sleep that are normally reported by the partner. Polysomnography is the chosen method for diagnosing this pathology. Patients with this disorder tend to have the following dental and orofacial signs: a retrognathic jaw, a narrow palate, a wide neck, deviation of the nasal septum and relative macroglossia, among others. Dentists should be ready to evaluate the risk-benefit of certain dental treatment options for this public health problem. The treatment of this problem will depend on its severity, with one of the options being the Mandibular Advancement Device (MAD) that is used especially in the treatment of slight or moderate SAHS and in the treatment of snoring, with results that are occasionally very successful. The objective of this study is to carry out an up-to-date literature review of SAHS and to evaluate the role of the dentist when faced with this pathology.

Key words: *Sleep apnea, mandibular advancement device, polysomnography.*

Introduction

Obstructive sleep apnea syndrome (SAHS) is a disorder that derives from the intermittent and repetitive occlusion of the upper airway during sleep. This occlusion is due to the inspiratory collapse of the walls of the pharynx, which determines the complete closure (apnea) or partial closure (hypopnea) of the airway. Apneas or hypopneas are of varying duration and have distinctive repercussions on cardiorespiratory homeostasis. Its repetition during sleep, sometimes several hundred times in one night, and day after day for years, ends up producing significant alterations in the central nervous system, in myocardial and cerebral circulation and in pulmonary and systemic circulation (1).

From a clinical point of view, SAHS is characterized by the daytime triad hypersomnia, snoring and nocturnal apnea generally reported by the affected person's partner and are symptoms simultaneously present in nearly all patients. What is more, other neuropsychiatric and cardiorespiratory disorders frequently occur, that are secondary to the constant oxygen desaturations and the transitory and subconscious awakenings ("arousals") that cause apneas (1).

SAHS is currently a public health problem of great importance. Firstly, its main clinical manifestation, daytime hypersomnia, has an important impact on the family, work and society, including a deterioration in personal relationships, job absenteeism, traffic accidents, etc. Secondly, its prevalence is estimated to be quite high (2-4). Studies recently carried out in our country have found varying figures, for the adult population, between 4% and 6 % in males and around 2 % in females (2,3).

After the Spanish consensus of 2005 (3), a recommendation was made to use the term "Sleep Apnea Hypopnea

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Aparotología intraoral en el tratamiento de la apnea-hipopnea obstructiva del sueño (SAHOS)

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Oral appliances in the treatment of obstructive sleep apnea-hypopnea syndrome

Resumen: Se describen las características de algunos de los aparatos más utilizados para el tratamiento de la apnea obstructiva del sueño y el ronquido crónico. La utilización de estos aparatos durante el sueño reposicionando la mandíbula y/o lengua en una posición más anterior, contribuye a evitar el ronquido y reducir significativamente, en algunos casos seleccionados, el índice de apneas hipopneas (AHI).

Palabras clave: Ronquido, Síndrome de apnea hipopnea obstructiva del sueño, Aparatos intraorales.

Abstract: Description of the characteristics of some of the most widely used devices for the treatment of obstructive sleep apnea and chronic snoring. The use of these devices during sleep to reposition the mandible and/or tongue to a more anterior position contributes to avoid snoring and to reduce considerably, in some selected cases, the apnea-hypopnea index (AHI).

Key words: Snore, Obstructive sleep apnea syndrome, Oral appliances.

29. Sutherland K, Vanderveken OM, Tsuda H, Marklund M, Gagnadoux F, Kushida CA, et al. Oral appliance treatment for obstructive sleep apnea: An update. J Clin Sleep Med. 2014;10(2):215–27.

REVIEW ARTICLES

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Oral Appliance Treatment for Obstructive Sleep Apnea: An Update

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Oral appliances (OA) have emerged as an alternative to continuous positive airway pressure (CPAP) for obstructive sleep apnea (OSA) treatment. The most commonly used OA reduces upper airway collapse by advancing the mandible (OA_m). There is a strong evidence base demonstrating OA_m improve OSA in the majority of patients, including some with more severe disease. However OA_m are not efficacious for all, with approximately one-third of patients experiencing no therapeutic benefit. OA_m are generally well tolerated, although short-term adverse effects during acclimatization are common. Long-term dental changes do occur, but these are for the most part subclinical and do not preclude continued use. Patients often prefer OA_m to gold-standard CPAP treatment. Head-to-head trials confirm CPAP is superior in reducing OSA parameters on polysomnography; however, this greater efficacy does not necessarily translate into better health outcomes in clinical practice. Comparable effectiveness of OA_m and CPAP has been attributed to higher reported nightly use of OA_m, suggesting that inferiority in reducing apneic events may be counteracted by greater treatment adherence. Recently, significant advances in commercially available OA_m technologies have been made. Remotely controlled mandibular positioners have the potential to identify treatment responders and the level of therapeutic advancement required in single night titration polysomnography. Objective monitoring of OA_m adherence using small embedded temperature sensing data loggers is now available and will enhance clinical practice and research. These technologies will further enhance efficacy and effectiveness of OA_m treatment for OSA.

Keywords: Obstructive sleep apnea, oral appliance, mandibular advancement, adherence, effectiveness

Citation: Sutherland K; Vanderveken OM; Tsuda H; Marklund M; Gagnadoux F; Kushida CA; Cistulli PA; on behalf of the ORANGE-Registry. Oral appliance treatment for obstructive sleep apnea: an update. *J Clin Sleep Med* 2014;10(2):215-227.

Obstructive sleep apnea (OSA) is a common sleep disorder characterized by recurring collapse of the upper airway during sleep, resulting in sleep fragmentation and oxygen desaturation. OSA is defined as the occurrence of 5 or more episodes of complete (apnea) or partial (hypopnea) upper airway obstruction per hour of sleep (apnea-hypopnea index [AHI]) and is estimated to occur in around 24% of middle-aged men and 9% of women.[1] Daytime symptoms such as sleepiness, cognitive impairment, and effects on quality of life require appropriate treatment. Furthermore the association of OSA with increased risk of motor vehicle accidents, cardiovascular morbidity, and all-cause mortality emphasize the need for effective long-term treatment.[2,3]

The gold standard treatment for OSA is to pneumatically splint open the upper airway during sleep using continuous positive airway pressure (CPAP). Although CPAP is highly efficacious in preventing upper airway collapse, patient acceptance, tolerance, and adherence is often low, thereby reducing effectiveness.[4] Hence, there is a major need for effective alternative treatments.

Oral appliances (OA) are designed to improve upper airway configuration and prevent collapse through alteration of jaw and tongue position. The most common mechanism of action is to hold the lower jaw in a more anterior position (OA_m). These appliances are variously termed "mandibular advancement devices (MAD)," "mandibular advancement splints (MAS)," or mandibular repositioning appliances (MRA)." Imaging studies show that mandibular advancement with OA_m enlarges the upper airway space, most notably in the lateral dimension of the velopharyngeal region.[5] Lateral expansion of the airway space is likely mediated through lateral tissue movement via direct tissue connections between the lateral walls and the ramus of the mandible.[6] Various amounts of anterior tongue movement also occur with mandibular advancement.[6] Alternative OA designs which protrude the tongue instead of the mandible (tongue-retaining device [TRD]) are also available.[7-9] TRDs feature an extra-oral flexible bulb and hold the tongue forward by suction, preventing its collapse into the airway. TRDs may be poorly tolerated, with inadequate device

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Ciencia

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Tratamiento ortodóncico del síndrome de apnea del sueño

Artículo ganador en los XII Premios Fin de Carrera de Odontología GACETA DENTAL

Resumen

Existe un gran número de personas afectadas por el síndrome de apnea hipoanea obstructiva del sueño (SAHOS), muchas de ellas aún sin diagnosticar.

Actualmente, la relación de los trastornos de la respiración durante el sueño con la cavidad oral de quien los padece, es tema de estudio en muchos países del mundo.

El objetivo de este artículo es resaltar el papel del odontólogo en la prevención y tratamiento de esta enfermedad mediante la utilización de aparatos intraorales.

Palabras clave: aparatología Intraoral; mandibular advancement; obstructive sleep apnea; oral appliances, orthodontics; ortodoncia, síndrome de apnea del sueño; sleep disorder; vía aérea superior.

Abreviaturas:
AHI: Índice de apnea-hipoapnea.
cPAP: Aparatología de Presión Positiva Continua de la vía aérea.
OSA: Obstructive Sleep Apnea.
RC: Roncopatía Crónica.
SAHS: Síndrome de apnea-hipoapnea del sueño.
UPPP Uvulopalatofaringoplastia.
VAS: Vía aérea superior.

Introducción

La Sociedad Española de Neumología y Cirugía Torácica (SEPAR) define el síndrome de apnea-hipoapnea durante el sueño (SAHS) como un cuadro caracterizado por somnolencia, trastornos neuropsiquiátricos y cardiorrespiratorios, secundarios a una alteración anatómico-funcional de la vía aérea superior que conduce a episodios repetidos de obstrucción de ésta durante el sueño, los cuales provocan descensos de la saturación de oxígeno en sangre que puede ser mayor al 4%, caída de los niveles de oxígeno en los pulmones y despertares transitorios que dan lugar a un sueño no reparador. Se acompaña de un ronquido intenso. Estos episodios se dan más cuando el paciente está en posición supina que en lateral, produciéndose alteraciones nocturnas y diurnas. Puede dar lugar a problemas de salud general o personalidad (1-7).

La apnea y la hipoapnea suelen ser factores comunes en los casos de respiración alterada durante el sueño. Está descrito que la apnea es una interrupción del flujo aéreo en un tiempo mayor o igual a 10 segundos en adultos, 15 en niños y 20 en neonatos prematuros; si lo que existe no es una detención, sino una reducción del flujo de aire en un 50%, se habla de hipoapnea, que también puede durar 10 s o más (4, 5).

El índice de apnea-hipoapnea se mide según el número

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An Overview of Oral Appliances and Managing the Airway in Obstructive Sleep Apnea

Mimi Yow

The literature supporting the efficacy and use of oral appliances in the management of obstructive sleep apnea (OSA) has grown enormously in the last two decades. The data gleaned from the studies of many researchers and practitioners have led to a better understanding of the role of oral appliances in managing patients with OSA, their clinical effectiveness and side effects, outcome predictors, tolerability and compliance formulated on evidence-based outcomes. This article gives an overview on the use of oral appliances in managing airway patency of pediatric and adult patients with OSA. (Semin Orthod 2009;15:88-93.)

A French stomatologist, Pierre Robin, first used oral appliances in the early 1900s for managing life-threatening upper airway obstruction in neonates born with the craniofacial disorder that was named after him. In addition to a cleft palate and hypoplastic mandible, a Pierre Robin patient has glossoptosis with risk of asphyxiation from the tongue positioned posteroinferiorly in a small oropharynx. Following the mechanical principles of managing airway obstructions, Pierre Robin sequence patients are positioned prone, with or without a monobloc appliance, a one-piece acrylic oral appliance, to posture the mandible forwards so that the tongue is protracted forwards and away from occluding the oropharyngeal airway. Severe cases are managed surgically.[1] Over the years, mandibular advancement appliances were developed for use as functional appliances in the dentofacial orthopedic treatment of growing children with hypoplastic and/or retrognathic mandibles.[2]

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Oral Appliances and Pediatric Obstructive Sleep Apnea (OSA)

OSA in children has complex etiologies with multifactorial interplay between the neuromuscular system, airway, and anatomical structures, which result in partial or complete obstruction of the upper airway. OSA is not graded in children. There are no distinctions between mild, moderate, or severe pediatric OSA. An apnea-hypopnea index (AHI) of 1 or greater indicates OSA in children. Input from several specialists is needed in the evaluation of children with OSA. The otolaryngologist, orthodontist, neurologist, pediatrician, and sleep technologist all play a part in diagnosing and identifying the causes for appropriate management. Sleep breathing problems in children commonly result from adenotonsillar hypertrophy. Neuromuscular conditions and/or craniofacial anomalies may compound the problem.[3]

Adenotonsillar hypertrophy frequently presenting in children at 2 to 8 years of age, and concomitant with certain craniofacial morphometrics, may compromise the pediatric airway.[4] Dentofacial characteristics that are closely associated with OSA in children include a narrow upper airway, hypoplastic maxilla, a retrognathic mandible with steep mandibular plane angle, narrow dental arches, high palatal vault, long soft palate, and an increased lower anterior facial height. Craniocervical angulation and lower anterior face height are larger than norm in children

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Changes in the upper airway of patients who wear a modified functional appliance to treat obstructive sleep apnea

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Affiliations + expand

PMID: 9081993

Abstract

This study was designed to investigate changes that occur in the upper airway of patients with obstructive sleep apnea who use a modified functional appliance. The experimental group included 10 men, all diagnosed with obstructive sleep apnea. Nuclear magnetic resonance imaging was carried out on each patient. One image was taken when the patient was in maximum habitual occlusion and another was taken while the patient wore the appliance. From the images gained, a three-dimensional reconstruction of the upper airway from the palatal plane was achieved. The images revealed statistically significant increases in the volume of the upper airway with the use of a modified functional appliance. Three-dimensional studies of the upper airway show greater detail and therefore seem likely to have more validity than two-dimensional studies.

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PART THREE
IN A SERIES

Types of oral appliances for the treatment of snoring and OSA

By Derek Mahony, BDS, MScOrth, DOrth RCS, MDOrth RCPS, MOrth RCS, FRCD, MOrth RCS/CDS, FICD, IBO

"The key is to get a proper diagnosis, seek treatment and understand that, if a CPAP device doesn't work for whatever reason, alternatives are available, such as dental appliances..."

Snoring and/or sleep apnea affects 3 million Australians. A CPAP device is the gold standard for treating this condition. CPAP stands for continuous positive airway pressure and this is facilitated by a machine that increases air pressure in the throat. The air is forced through with a mask that covers the nose, the nose and mouth or prongs that fit into the nose.

Increasingly, patients often do not find success with this device for a variety of reasons, and for some this results in a really diminished quality of life.

For those patients, alternatives such as dental appliances and surgery are available, but determining which option is ideal can be taxing on patients, often causing them to see a variety of specialists separately.

The ideal solution should be a multi-disciplinary clinic with a number of health care providers consulting the patient simultaneously. These clinicians would include a sleep medicine specialist, a dentist, a maxillofacial surgeon and an ear, nose and throat doctor. "This approach is mainly for cases that cannot tolerate standard treatment, which is CPAP," says Dr Alp Baran, a sleep medicine specialist, psychiatrist and director of The Sleep Disorders Center at the University of Mississippi Medical Center.

Not being able to tolerate treatment can be a combination of the discomfort of using the CPAP unit; that it disturbs your bed partner; or that it is inconvenient to transport if you travel often. As a result of untreated OSA, some patients battle depression and decreased libido, lose their jobs and cannot maintain relationships.

ENT doctors often perform surgeries on sleep apnea patients to remove adenoids, tonsils, nasal polyps or tissue that blocks airways, but studying sleep medicine takes research a step further. The author is currently enrolled in a Masters of Sleep Medicine at the University of Sydney that offers a more multi-disciplinary background and shows that some sleep apnea patients are not being adequately treated, often only being recommended one treatment approach such as a CPAP or a dental appliance.

I manage sleep apnea patients on referral from a medical team and fit them with dental appliances when a CPAP isn't tolerable and surgery isn't needed or desired. These oral devices are used for those patients with mild to moderate sleep apnea and work by repositioning the lower jaw and the tongue to increase the oropharyngeal airway. However, in many cases patients may require a multidisciplinary mode of treatment that involves CPAP; surgery to the nose and/or soft palate; reduction of allergies; diet/weight loss/exercise; and a mandibular advancement device to achieve an adequate reduction in their apnoea/hypopnea index (AHI) score.

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In italiano, per favore
In english, please

Re-Published Article*
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Apnea Obstructiva y Ronquidos Cronico

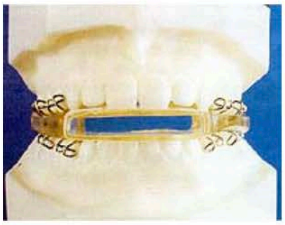
"Tratamiento con aparatos dentales usados durante la noche"

Nicola Lambini Dent. Techn. Padova

Traducción al español: Dr. Jorge Mayora I.

*Esta artículo apareció en el 54avo "Bollettino di Informazioni Ortodontiche".
Reimpreso y traducido con la autorización del editor de Leone S.p.A.

Resumen: El autor describe las características de varios aparatos usados para el tratamiento de la apnea obstructiva y el ronquido crónico. El uso nocturno de esos aparatos puede evitar el ronquido reposicionando la mandíbula y la lengua anteriormente.



El ronquido es una de las más comunes y desagradables conductas involuntarias. Puede contribuir a problemas familiares y a irritabilidad entre las parejas. En un estudio estadístico en personas sobre los 40 años, el 60% de hombres y el 40% de mujeres se encontró que roncaban.

Los médicos usualmente sugieren la pérdida de peso, dormir de lado, o simplemente tolerar la situación. En casos muy severor, los médicos pueden sugerir una solución quirúrgica para ampliar la vía aerea con una uvulopalatofaringoplastía (UPPP) o instalar un dispositivo de presión positiva contínua en la vía aérea (CPAP), el cuál, es un compresor para bombear aire a los pulmones durante toda la noche a través de una mascarilla nasal.

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Sleep, 18(6):501–510

An American Sleep Disorders Association Review

Oral Appliances for the Treatment of Snoring and Obstructive Sleep Apnea: A Review

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Summary: This paper, which has been reviewed and approved by the Board of Directors of the American Sleep Disorders Association, provides the background for the Standards of Practice Committee's parameters for the practice of sleep medicine in North America. The 21 publications selected for this review describe 320 patients treated with oral appliances for snoring and obstructive sleep apnea. The appliances modify the upper airway by changing the posture of the mandible and tongue. Despite considerable variation in the design of these appliances, the clinical effects are remarkably consistent. Snoring is improved and often eliminated in almost all patients who use oral appliances. Obstructive sleep apnea improves in the majority of patients; the mean apnea-hypopnea index (AHI) in this group of patients was reduced from 47 to 19. Approximately half of treated patients achieved an AHI of <10; however, as many as 40% of those treated were left with significantly elevated AHIs. Improvement in sleep quality and sleepiness reflects the effect on breathing. Limited follow-up data indicate that oral discomfort is a common but tolerable side effect, that dental and mandibular complications appear to be uncommon and that long-term compliance varies from 50% to 100% of patients. Comparison of the risk and benefit of oral appliance therapy with the other available treatments suggests that oral appliances present a useful alternative to continuous positive airway pressure (CPAP), especially for patients with simple snoring and patients with obstructive sleep apnea who cannot tolerate CPAP therapy. **Key Words:** Sleep apnea syndromes—Snoring—Orthodontic appliances—Diagnosis—Therapy.

1.0 INTRODUCTION

An oral appliance was considered as treatment for mandibular deficiency and upper airway obstruction as early as 1902 (1). With the recent interest in sleep apnea, oral appliances of various designs have been proposed and studied, and are used increasingly to treat snoring and sleep apnea. The purpose of this review is to evaluate evidence regarding the effectiveness of these devices. The term "oral appliance" is used as a generic term for devices inserted into the mouth in order to modify the position of the mandible, the tongue, and other structures in the upper airway for the purpose of relieving snoring or sleep apnea. Although many of these devices attach to the teeth and use conventional dental technology, we use the more general term to include devices that are used intraorally but are not necessarily retained directly by the teeth.

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The authors are a task force of the Standards of Practice Committee of the American Sleep Disorders Association.

2.0 METHODS

2.1 Selection of papers

The data for this review were derived from computer searches of the clinical literature (MEDLINE, July 1994;

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J. Sleep Res. (2009) 18, 321–328 Sleep disordered breathing

doi: 10.1111/j.1365-2869.2009.00738.x

A randomized prospective long-term study of two oral appliances for sleep apnoea treatment

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Accepted in revised form 25 November 2008; received 29 August 2008

SUMMARY Various types of mandibular protrusive appliances have revealed different treatment success in mild-to-moderate obstructive sleep apnoea (OSA). The present study compared the long-term effect of two different appliances in the treatment of OSA. A total of 103 patients with OSA were randomized and treated with an IST® or Thornton Anterior Positioner (TAP™) appliance. They were followed-up after a short-term treatment period of 6 months and long-term treatment period of over 24 months. Sleep studies in the sleep laboratory were conducted with and without the appliances, and various questionnaires assessing subjective daytime sleepiness, sleep quality, quality of life and symptom scores were administered at each time interval. Quality of life, sleep quality, sleepiness, symptoms and sleep outcome showed significant improvement in the short-term evaluation with both appliances, but the TAP™ appliance revealed a significantly greater effect. After more than 2 years of treatment, sleep outcomes revealed an equal effect with both appliances. The subjective benefits achieved initially lessened significantly. This study illustrates that both the IST® and the TAP™ appliances are effective therapeutic devices for OSA after a period of over 24 months. Lack of compliance may be due to insufficient improvement in anticipated subjective symptoms and/or a recurrence of symptoms over time.

KEYWORDS mandibular advancement devices, obstructive sleep apnoea, oral appliances, sleep apnoea syndrome, sleep-disordered breathing

INTRODUCTION

The obstructive sleep apnoea (OSA) syndrome is treated by the nocturnal application of continuous positive airway pressure (CPAP). Although CPAP is the most efficacious treatment (Giles *et al.*, 2006), limited acceptance as long-term treatment has been described (Barnes *et al.*, 2004; Engleman *et al.*, 1999; Ferguson *et al.*, 1997; Redline *et al.*, 1998). Custom-made mandibular advancement appliances (MAAs) reduce symptoms in OSA and subjective sleepiness, but less than CPAP (Barnes *et al.*, 2002; Clark *et al.*, 1996; Engleman *et al.*, 1999; Ferguson *et al.*, 1997; Randerath *et al.*, 2002). Treatment recommendations for the use of MAA have been updated recently (Kushida *et al.*, 2006; Lim *et al.*, 2006).

Most studies have verified MAAs' effectiveness in short-term evaluations in different clinical endpoints and patients' perception. The long-term effect was evaluated in a retrospective case–control study over 5 years, and found to change relatively little (Marklund *et al.*, 2001). However, a recent meta-analysis of OSA treatment modalities concluded that the long-term data on treatment outcomes to determine whether initial benefits in short-term clinical trials persist are inadequate (Lim *et al.*, 2006).

Several MAAs of different constructional design and made of various dental materials are currently in clinical use (Hoffstein, 2007). The different MAA designs may influence therapeutic outcome, compliance and persistence of usage. Regarding the persistence of MAA usage, there is a lack of comparable studies evaluating the efficacy of different types of

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RCOE
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RCOE vol.7 no.4 jul./ago. 2002

Tratamiento de la apnea obstructiva del sueño con posicionadores mandibulares


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Treatment of sleep apnea syndrome with mandibular advancing devices

Resumen: Desde finales del siglo pasado los aparatos intraorales han sido considerados como una alternativa válida para ciertos tipos de patología obstructiva de la vía aérea superior. En el momento actual existen múltiples patentes de diferentes aparatos. Los más comúnmente utilizados son los aparatos de avance mandibular (MAD) fijos y de avance ajustable. Su función puede resumirse como un aumento del área faríngea y prevención del colapso de paladar blando y lengua durante el sueño. Con estos aparatos se consiguen reducciones del indice de apnea hipoapnea (AHI) del orden del 60%, el rango de respuesta es del 60% y la adaptación de los pacientes está por encima del 80%, cifras que los hacen comparables a los aparatos de presión positiva (CPAP) para la reducción de los desórdenes respiratorios durante el sueño. Y superiores a la CPAP en cuanto a aceptación por parte de los pacientes y menores efectos secundarios.

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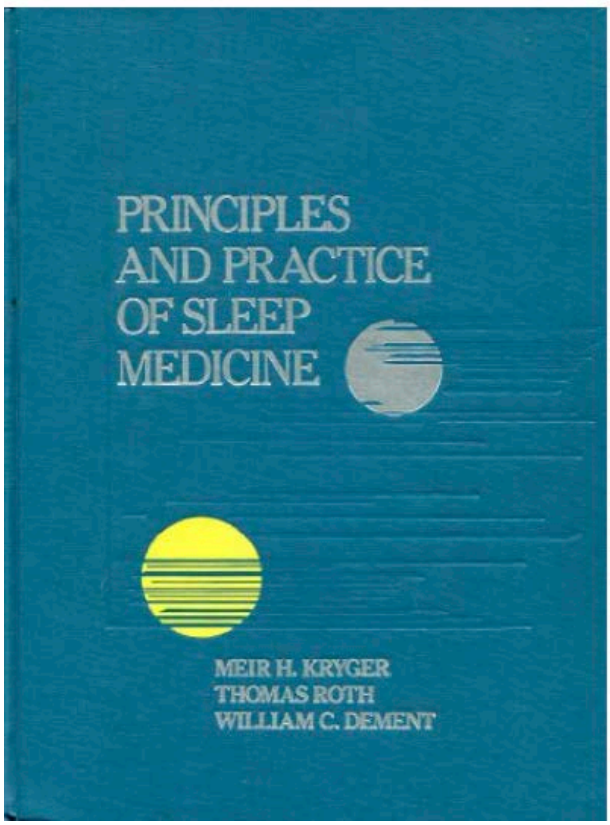

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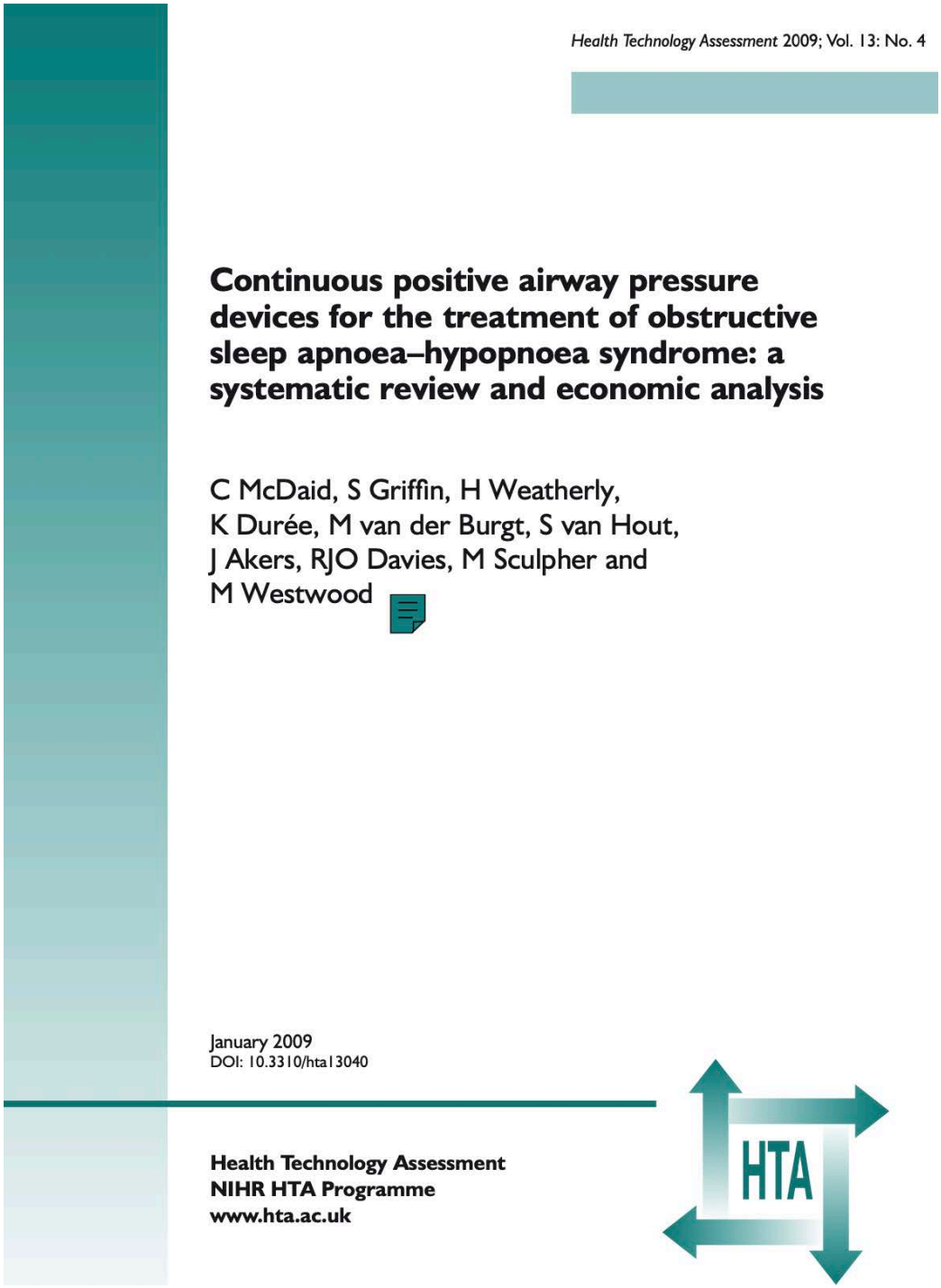

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Eur Respir J 2006; 28: 1020–1028
DOI: 10.1183/09031936.06.00112905

Driving ability in sleep apnoea patients before and after CPAP treatment: evaluation on a road safety platform

S. Mazza*,#, J-L. Pépin*,#, B. Naëgelé*,#, E. Rauch*,#, C. Deschaux¶, P. Ficheux+ and P. Lévy*,#

ABSTRACT: **Sleepiness is considered to be the major cause of increased traffic accidents in patients with obstructive sleep apnoea syndrome (OSAS). Until now, OSAS patients' driving ability has been assessed using driving simulators, but no assessment in a more natural driving environment has been carried out to date.**

The aim of the present study was to evaluate driving parameters in OSAS and in controls on a road safety platform, and to compare them with attentional in-laboratory measures before and after continuous positive airway pressure treatment.

The parameters measured were: reaction time; distance to stop and number of collisions on the platform; maintenance of wakefulness; and sustained, selective and divided attention in laboratory.

Patients exhibited much longer reaction times than controls, leading to a lengthening of the vehicle's stopping distance of 8.8 m at 40 km·h^{-1} and to twice the number of collisions. Patients did not demonstrate objective sleepiness or selective and sustained attention deficits. Divided attention deficits were found. However, they did not allow the prediction of real driving impairment. After CPAP treatment, there was no longer any difference between patients and controls regarding driving and attention performances.

Driving abilities are significantly impaired in obstructive sleep apnoea syndrome. After continuous positive airway pressure treatment, deficits were normalised. This stresses the importance of evaluating attentional parameters in apnoeic patients and of offering continuous positive airway pressure treatment even to non-sleepy subjects.

KEYWORDS: **Attention, driving performance, reaction time, sleep apnoea**

In recent years, concern regarding motor-vehicle accidents related to sleepiness has increased. In France, the national road safety agency estimated that in 2003 one out of four fatal highway accidents was directly related to sleepiness.

Several risk factors for the occurrence of sleepiness at the wheel exist, including long periods of wakefulness, time of day, alcohol and drug consumption, work hours, reduced sleep time, and sleep disorders resulting in excessive daytime sleepiness, such as obstructive sleep apnoea syndrome (OSAS).

OSAS is a common and underestimated sleep disorder affecting ~4% of middle-aged males [1]. This syndrome is characterised by repeated complete (apnoea) or partial (hypopnoea) collapses of the upper airway during sleep. These events cause micro-arousals and nocturnal oxygen desaturation thought to be responsible for sleep fragmentation and excessive daytime sleepiness.

Retrospective studies, based on subjective and objective records, have shown that the rate of traffic accidents among drivers with sleep apnoea is increased by two to seven times compared with non-apnoeic drivers [2–4]. However, even if most of the evidence suggests that OSAS leads to an increased risk when driving, these results have been criticised based on epidemiological and methodological considerations [5] and interindividual susceptibility [6].

Studies assessing the relationship between excessive sleepiness and accidents have shown conflicting results for both subjective and objective tests [1–3, 7, 8]. These results could be explained

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CLINICAL REVIEW

Nasal continuous positive airway pressure (nCPAP) treatment for obstructive sleep apnea, road traffic accidents and driving simulator performance: A meta-analysis

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SUMMARY

We used meta-analysis to synthesize current evidence regarding the effect of nasal continuous positive airway pressure (nCPAP) on road traffic accidents in patients with obstructive sleep apnea (OSA) as well as on their performance in driving simulator. The primary outcomes were real accidents, near miss accidents, and accident-related events in the driving simulator. Pooled odds ratios (ORs), incidence rate ratios (IRRs) and standardized mean differences (SMDs) were appropriately calculated through fixed or random effects models after assessing between-study heterogeneity. Furthermore, risk differences (RDs) and numbers needed to treat (NNTs) were estimated for real and near miss accidents. Meta-regression analysis was performed to examine the effect of moderator variables and publication bias was also evaluated. Ten studies on real accidents (1221 patients), five studies on near miss accidents (769 patients) and six studies on the performance in driving simulator (110 patients) were included. A statistically significant reduction in real accidents (OR = 0.21, 95% CI = 0.12–0.35, random effects model; IRR = 0.45, 95% CI = 0.34–0.59, fixed effects model) and near miss accidents (OR = 0.09, 95% CI = 0.04–0.21, random effects model; IRR = 0.23, 95% CI = 0.08–0.67, random effects model) was observed. Likewise, a significant reduction in accident-related events was observed in the driving simulator (SMD = −1.20, 95% CI = −1.75 to −0.64, random effects). The RD for real accidents was −0.22 (95% CI = −0.32 to −0.13, random effects), with NNT equal to five patients (95% CI = 3–8), whereas for near miss accidents the RD was −0.47 (95% CI = −0.69 to −0.25, random effects), with NNT equal to two patients (95% CI = 1–4). For near miss accidents, meta-regression analysis suggested that nCPAP seemed more effective among patients entering the studies with higher baseline accident rates. In conclusion, all three meta-analyses demonstrated a sizeable protective effect of nCPAP on road traffic accidents, both in real life and virtual environment.

Introduction

Obstructive sleep apnea (OSA) is a common chronic disorder that affects approximately 20% of the general population if defined as an apneae hypopnea index (AHI) ≥ 5 events/h, or 2–9% if defined as an AHI ≥ 5 events/h accompanied by at least one symptom that is known to respond to treatment, such as daytime sleepiness.[1–3] The high prevalence rates are disturbing taking under consideration that OSA patients have an increased risk of morbidity and mortality, particularly due to cardiovascular disease or involvement in road traffic accidents. Indeed, OSA patients are often sleepy during daytime causing traffic accidents and work injuries.[4,5] If left untreated, OSA leads to excessive daytime sleepiness, cognitive dysfunction, impaired work performance, and decrements in quality of life.[6]

Many treatment modalities have been proposed for the treatment of OSA including dietary and lifestyle management, pharmacological agents, oral appliance devices and surgical interventions (nasal reconstruction, various uvulopalatopharyngoglossoplasty techniques, maxillomandibular manipulations, and tracheotomy). Despite the variety of alternative choices, nasal

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Odontología y síndrome de apneas-hipopneas del sueño. Evidencias y necesidades para su integración

Dentistry and sleep apnea-hypopnea syndrome. Evidence and needs for integration

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Resumen

Introducción: El síndrome de apneas-hipopneas del sueño SAHS es un trastorno frecuente e infradiagnosticado y con una elevada morbi-mortalidad asociada. En Odontología, la educación y formación en el diagnóstico de los trastornos del sueño y en el uso de terapias de aplicación oral, es limitado.
Material y métodos: Este estudio se ha basado en una revisión bibliográfica de los principales estudios publicados recientemente sobre la apnea-hipopnea del sueño.
Resultados: Los estudios publicados coinciden en señalar que el odontólogo se encuentra en una posición estratégica para contribuir al diagnóstico y tratamiento de las alteraciones del sueño. Por otra parte, son necesarios más estudios que valoren la eficacia de los tratamientos de aplicación oral en el síndrome de apneas del sueño y en las principales consecuencias asociadas al mismo.
Discusión: En esta revisión se resumen los principales resultados publicados hasta la fecha, en los que se evidencia la necesidad de una mayor formación y la importancia del odontólogo en el abordaje de esta patología.

Palabras clave: Apnea del sueño, dispositivo oral, tratamiento ortodóncico, aparato dental

Abstract

Introduction: Sleep apnea-hypopnea syndrome SAHS is a frequent and underdiagnosed disorder with a high associated morbidity and mortality. In dentistry, education and training in the diagnosis of sleep disorders and in the use of oral application therapies is limited.
Material and methods: This study has been based on a literature review of the most recently published studies.
Results: The published studies coincide in pointing out that the dentist is in a strategic position to contribute to the diagnosis and treatment of sleep disturbances. On the other hand, more studies are necessary that evaluate the effectiveness of the treatments of oral application in the syndrome of sleep apneas and in the main consequences associated with the same one.
Discussion: This review summarizes the main results published to date, which demonstrate the need for greater training and the importance of the dentist in the treatment of this pathology.

Keywords: Sleep apnea, oral appliance, orthodontic treatment, dental appliance

45. Carrera M, Barbé F, Sauleda J, Tomás M, Gómez C, Agustí AG. Patients with obstructive sleep apnea exhibit genioglossus dysfunction that is normalized after treatment with continuous positive airway pressure. Am J Respir Crit Care Med. 1999;159(6):1960–6.

Patients with Obstructive Sleep Apnea Exhibit Genioglossus Dysfunction that Is Normalized after Treatment with Continuous Positive Airway Pressure

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Obstructive sleep apnea syndrome (OSAS) is characterized by repetitive episodes of pharyngeal closure during sleep. The pathogenesis of OSAS is unclear. We hypothesized that the genioglossus (GG), the most important pharyngeal dilator muscle, would be abnormal in patients with OSAS. Further, because treatment with continuous positive airway pressure (CPAP) is very effective clinically in these patients, we investigated the effects of CPAP upon the structure and function of the GG. We studied 16 patients with OSAS (nine of them at diagnosis and seven after having been under treatment with CPAP for at least 1 yr) and 11 control subjects in whom OSAS was excluded clinically. A biopsy of the GG was obtained in each subject, mounted in a tissue bath, and stimulated through platinum electrodes. The following measurements were obtained: maximal twitch tension, contraction time, half-relaxation time, the force-frequency relationship, and the response to a fatiguing protocol. The percentage of type I ("slow twitch") and type II ("fast twitch") fibers was also quantified. Patients with OSAS showed a greater GG fatigability than did control subjects (ANOVA, $p < 0.001$). Interestingly, this abnormality was entirely corrected by CPAP. Likewise, the percentage of type II fibers was significantly higher in patients with OSAS ($59 \pm 4\%$) than in control subjects ($39 \pm 4\%$, $p < 0.001$) and, again, these structural changes were corrected by CPAP ($40 \pm 3\%$, $p < 0.001$). These results show that the function and structure of the GG is abnormal in patients with OSAS. Because these abnormalities are corrected by CPAP, we suggest that they are likely a consequence, not a cause, of the disease. Carrera M, Barbé F, Sauleda J, Tomás M, Gómez C, Agustí AGN. Patients with obstructive sleep apnea exhibit genioglossus dysfunction that is normalized after treatment with continuous positive airway pressure. **AM J RESPIR CRIT CARE MED 1999;159:1960–1966.**

The obstructive sleep apnea syndrome (OSAS) is a major public health problem (1). It is a frequent disease that affects about 2% of women and 4% of men, and it associates significant morbidity and mortality (2–4). OSAS is characterized by the repetition of episodes of pharyngeal closure during sleep. The pathogenesis of these episodes, which may occur hundreds of times each night, is not fully understood (5). However, it is accepted that the maintenance of pharyngeal patency depends on the equilibrium between several occluding and dilating forces (5). Among the latter, the activity of the pharyngeal dilator muscles is of fundamental importance (5). The genioglossus (GG) is the most important pharyngeal dilator muscle (6, 7). As such, therefore, it is conceivable that the GG might play a role in the pathogenesis of OSAS.

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Am J Respir Crit Care Med Vol 159. pp 1960–1966, 1999
Internet address: www.atsjournals.org

Hypothetically, the GG can be abnormal in OSAS by two different mechanisms. On the one hand, a primary myopathy of the GG may enhance pharyngeal collapsibility in these patients. Alternatively, because each episode of pharyngeal obstruction finishes with a vigorous contraction of the GG (5), a secondary process of muscle injury and repair may ensue. In turn, this may jeopardize the mechanical properties of the GG and render the pharynx more collapsible (8).

Treatment with continuous positive airway pressure (CPAP) is highly effective in OSAS (9). In these patients CPAP acts as an effective pneumatic splint that prevents pharyngeal collapse (9, 10). As such, CPAP effectively rests the GG (9, 11, 12). It is well established that a transition between different muscle fiber types occur in response to changes in the pattern and/or level of muscle activation (8). Therefore, CPAP has the potential to revert a hypothetical GG dysfunction, particularly if this was the consequence (rather than the cause) of the episodes of pharyngeal closure that characterize OSAS.

In this study, we hypothesized that the GG may be abnormal (both functionally and structurally) in patients with OSAS. To test this hypothesis, we compared the *in vitro* contractile properties and the fiber type distribution of GG samples obtained from subjects with and without OSAS. To distinguish a

46. Barbe F, Duran-Cantolla J, Sanchez-de-le-Torre M, et al. Effect of continuous positive airway pressure on the incidence of hypertension and cardiovascular events in non-sleepy patients with obstructive sleep apnea: a randomized controlled trial. JAMA. 2012; 307:2161-2168.

ORIGINAL CONTRIBUTION

Scan for Author Video Interview

Effect of Continuous Positive Airway Pressure on the Incidence of Hypertension and Cardiovascular Events in Nonsleepy Patients With Obstructive Sleep Apnea

A Randomized Controlled Trial

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Context Continuous positive airway pressure (CPAP) is the first-line treatment for patients with symptomatic obstructive sleep apnea (OSA). However, its indication for all patients with sleep-disordered breathing, regardless of daytime symptoms, is unclear.

Objective To evaluate the effect of CPAP treatment on the incidence of hypertension or cardiovascular events in a cohort of nonsleepy patients with OSA.

Design, Setting, and Patients Multicenter, parallel-group, randomized controlled trial in 14 teaching hospitals in Spain. Between May 2004 and May 2006, 725 consecutive patients were enrolled who had an apnea-hypopnea index of 20 h^{-1} or greater and an Epworth Sleepiness Scale score of 10 or less (scores range from 0-24, with values <10 suggesting no daytime sleepiness). Exclusion criteria were previous cardiovascular event, physical or psychological incapacity, chronic disease, or drug or alcohol addiction. Follow-up ended in May 2009.

Intervention Patients were allocated to receive CPAP treatment or no active intervention. All participants received dietary counseling and sleep hygiene advice.

Main Outcome Measures Incidence of either systemic hypertension (taking antihypertensive medication or blood pressure greater than 140/90 mm Hg) or cardiovascular event (nonfatal myocardial infarction, nonfatal stroke, transient ischemic attack, hospitalization for unstable angina or arrhythmia, heart failure, or cardiovascular death).

Results Seven hundred twenty-three patients underwent follow-up for a median of 4 (interquartile range, 2.7-4.4) years (1 patient from each group did not receive allocated treatment); 357 in the CPAP group and 366 in the control group were included in the analysis. In the CPAP group there were 68 patients with new hypertension and 28 cardiovascular events (17 unstable angina or arrhythmia, 3 nonfatal stroke, 3 heart failure, 2 nonfatal myocardial infarction, 2 transient ischemic attack, 1 cardiovascular death). In the control group there were 79 patients with new hypertension and 31 cardiovascular events (11 unstable angina or arrhythmia, 8 nonfatal myocardial infarction, 5 transient ischemic attack, 5 heart failure, 2 nonfatal stroke). The hypertension or cardiovascular event incidence density rate was 9.20 per 100 person-years (95% CI, 7.36-11.04) in the CPAP group and 11.02 per 100 person-years (95% CI, 8.96-13.08) in the control group. The incidence density ratio was 0.83 (95% CI, 0.63-1.1; $P=.20$).

Conclusions In patients with OSA without daytime sleepiness, the prescription of CPAP compared with usual care did not result in a statistically significant reduction in the incidence of hypertension or cardiovascular events. However, the study may have had limited power to detect a significant difference.

Trial Registration clinicaltrials.gov Identifier: NCT00127348

JAMA. 2012;307(20):2161-2168 www.jama.com

OBSTRUCTIVE SLEEP APNEA (OSA) is a common disease that affects 3% to 7% of the general population.[1,2] Sleep apnea is caused by the collapse of the upper airway during sleep, which leads to transient asphyxia. These events lead to brain arousal, intermittent hypoxemia (which induces hypersomnolence), poor quality of life, and metabolic disturbances. Cross-sectional and longitudinal studies have shown an association between OSA and hyperten-

See also pp 2169 and 2197.

Author Video Interview available at www.jama.com.

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Original Article

Chronic Respiratory Disease

Chronic Respiratory Disease
2015, Vol. 12(4) 320–328

DOI: 10.1177/1479972315594624
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Motor vehicle accidents and obstructive sleep apnea syndrome: A methodology to calculate the related burden of injuries

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Abstract

The association between motor vehicle accidents (MVAs) and obstructive sleep apnea syndrome (OSAS) has always been quantified as risk of MVAs for individual drivers with OSAS. We evaluated the expected injured patients per year attributable to OSAS-dependent MVAs in a general population. By combining OSAS prevalence and OSAS-dependent MVAs odds ratio, we assessed the population attributable fraction (PAF), an epidemiological tool that can be used to quantify the proportion of road traffic injuries (RTIs) attributable to OSAS. For an apnea hypopnea index ≥5, the weighed median and combined average of OSAS prevalence were 4.4 (95% confidence interval (CI): 3.7–7.5) and 4.7 (95% CI: 4.2–5.2), respectively; values of risk of OSAS-dependent MVAs were 2.83 (95% CI: 2.72–3.08) and 2.52 (95% CI: 2.07–3.08), respectively. The PAF showed weighed median and combined average values of 6.6 (95% CI: 4.3–9.8) and 7.3% (95% CI: 6.0–13.5), respectively. Our results show that about 7% of RTIs for a population of male drivers involved in MVAs are attributable to OSAS. This value can be used to assess the potential impact, on the reduction of incidence of the motor vehicle injuries, of prevention programs aimed at reducing the number of subjects with an undiagnosed and/or untreated OSAS.

Keywords

Obstructive sleep apnea syndrome, road traffic injuries, motor vehicle accidents, population attributable fraction, public health

Introduction

Obstructive sleep apnea syndrome (OSAS) is a chronic respiratory disease characterized by recurrent sleep-related obstruction of the upper airway.[1] OSAS prevalence is estimated to range between 3.1% and 7.5% of the adult male population,[2] and the most common symptoms are habitual snoring (HS), observed apnea, and excessive daytime sleepiness (EDS).[3] Subjects with OSAS have a two- to seven-fold increased risk of being involved in motor vehicle accidents (MVAs).[4–13] The treatment of OSAS with continuous positive airway pressure reduces the number of MVAs compared to the number observed in the general population[14] with saving of lives and reduction in direct and indirect medical costs.[15] In view of the increasing impact that OSAS-dependent MVAs has on health and social systems[16] in Australia, the National Transport Commission and Austroads have indicated the medical standards for

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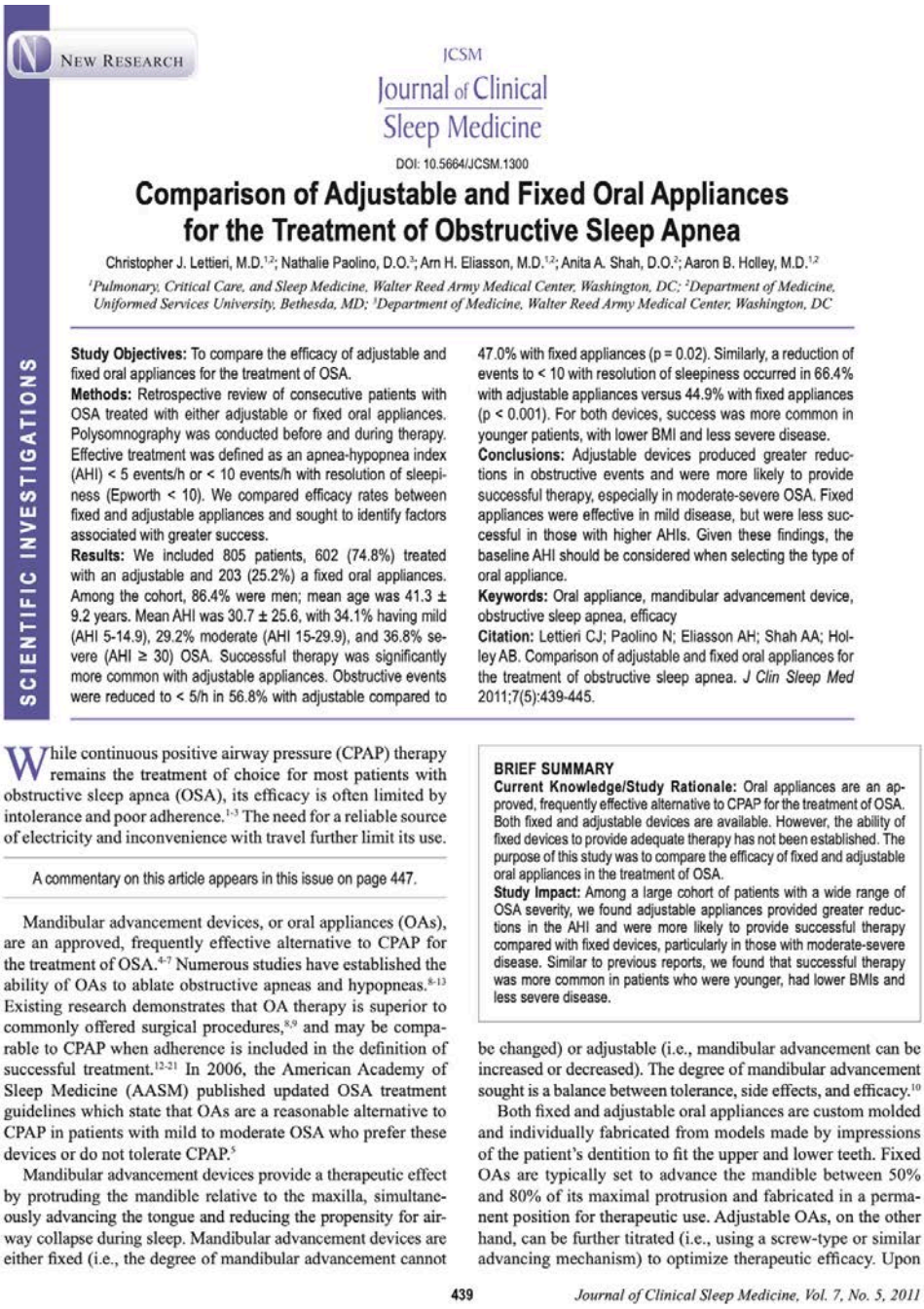

NEW RESEARCH

SCIENTIFIC INVESTIGATIONS

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Comparison of Adjustable and Fixed Oral Appliances for the Treatment of Obstructive Sleep Apnea

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Study Objectives: To compare the efficacy of adjustable and fixed oral appliances for the treatment of OSA.

Methods: Retrospective review of consecutive patients with OSA treated with either adjustable or fixed oral appliances. Polysomnography was conducted before and during therapy. Effective treatment was defined as an apnea-hypopnea index (AHI) < 5 events/h or < 10 events/h with resolution of sleepiness (Epworth < 10). We compared efficacy rates between fixed and adjustable appliances and sought to identify factors associated with greater success.

Results: We included 805 patients, 602 (74.8%) treated with an adjustable and 203 (25.2%) a fixed oral appliances. Among the cohort, 86.4% were men; mean age was 41.3 ± 9.2 years. Mean AHI was 30.7 ± 25.6, with 34.1% having mild (AHI 5-14.9), 29.2% moderate (AHI 15-29.9), and 36.8% severe (AHI ≥ 30) OSA. Successful therapy was significantly more common with adjustable appliances. Obstructive events were reduced to < 5/h in 56.8% with adjustable compared to 47.0% with fixed appliances (p = 0.02). Similarly, a reduction of events to < 10 with resolution of sleepiness occurred in 66.4% with adjustable appliances versus 44.9% with fixed appliances (p < 0.001). For both devices, success was more common in younger patients, with lower BMI and less severe disease.

Conclusions: Adjustable devices produced greater reductions in obstructive events and were more likely to provide successful therapy, especially in moderate-severe OSA. Fixed appliances were effective in mild disease, but were less successful in those with higher AHIs. Given these findings, the baseline AHI should be considered when selecting the type of oral appliance.

Keywords: Oral appliance, mandibular advancement device, obstructive sleep apnea, efficacy

Citation: Lettieri CJ; Paolino N; Eliasson AH; Shah AA; Holley AB. Comparison of adjustable and fixed oral appliances for the treatment of obstructive sleep apnea. *J Clin Sleep Med* 2011;7(5):439-445.

While continuous positive airway pressure (CPAP) therapy remains the treatment of choice for most patients with obstructive sleep apnea (OSA), its efficacy is often limited by intolerance and poor adherence.[1-3] The need for a reliable source of electricity and inconvenience with travel further limit its use.

A commentary on this article appears in this issue on page 447.

Mandibular advancement devices, or oral appliances (OAs), are an approved, frequently effective alternative to CPAP for the treatment of OSA.[4-7] Numerous studies have established the ability of OAs to ablate obstructive apneas and hypopneas.[8-13] Existing research demonstrates that OA therapy is superior to commonly offered surgical procedures,[8,9] and may be comparable to CPAP when adherence is included in the definition of successful treatment.[12-21] In 2006, the American Academy of Sleep Medicine (AASM) published updated OSA treatment guidelines which state that OAs are a reasonable alternative to CPAP in patients with mild to moderate OSA who prefer these devices or do not tolerate CPAP.[5]

Mandibular advancement devices provide a therapeutic effect by protruding the mandible relative to the maxilla, simultaneously advancing the tongue and reducing the propensity for airway collapse during sleep. Mandibular advancement devices are either fixed (i.e., the degree of mandibular advancement cannot be changed) or adjustable (i.e., mandibular advancement can be increased or decreased). The degree of mandibular advancement sought is a balance between tolerance, side effects, and efficacy.[10]

Both fixed and adjustable oral appliances are custom molded and individually fabricated from models made by impressions of the patient's dentition to fit the upper and lower teeth. Fixed OAs are typically set to advance the mandible between 50% and 80% of its maximal protrusion and fabricated in a permanent position for therapeutic use. Adjustable OAs, on the other hand, can be further titrated (i.e., using a screw-type or similar advancing mechanism) to optimize therapeutic efficacy. Upon

BRIEF SUMMARY

Current Knowledge/Study Rationale: Oral appliances are an approved, frequently effective alternative to CPAP for the treatment of OSA. Both fixed and adjustable devices are available. However, the ability of fixed devices to provide adequate therapy has not been established. The purpose of this study was to compare the efficacy of fixed and adjustable oral appliances in the treatment of OSA.

Study Impact: Among a large cohort of patients with a wide range of OSA severity, we found adjustable appliances provided greater reductions in the AHI and were more likely to provide successful therapy compared with fixed devices, particularly in those with moderate-severe disease. Similar to previous reports, we found that successful therapy was more common in patients who were younger, had lower BMIs and less severe disease.

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REVISIÓN

Dispositivos orales en el tratamiento del síndrome de apnea-hipopnea del sueño

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INTRODUCCIÓN

La Sociedad Española de Neumología y Cirugía Torácica (SEPAR) define el síndrome de apnea-hipopnea del sueño (SAHS) como un cuadro de somnolencia excesiva, trastornos cognitivo-conductuales, respiratorios, cardíacos, metabólicos o inflamatorios, secundarios a episodios repetidos de obstrucción de la vía aérea superior durante el sueño[1]. Se trata de una enfermedad muy prevalente, ya que afecta al 4-6% de los varones y al 2-4% de las mujeres en las edades medias de la vida, aumentado esta frecuencia con la edad[2].

La aplicación de presión positiva continúa sobre la vía aérea (CPAP) sigue siendo el tratamiento de elección en el SAHS. Esta modalidad terapéutica está indicada en los casos más severos, concretamente en aquellos enfermos con un índice de apnea-hipopnea (IAH) por encima de 30, teniendo que individualizarse su empleo en el resto de los pacientes[1,3]. Los dispositivos orales, particularmente los de avance mandibular (DAM), constituyen una alternativa a la terapia convencional. Están indicados en los pacientes que padecen una roncopatía simple, un SAHS de carácter leve o leve- moderado con un índice de masa corporal (IMC) normal o un síndrome de resistencia aumentada de la vía aérea (SAR-VAS). También constituyen una alternativa en los enfermos con un SAHS severo que rechazan o no toleran el tratamiento con CPAP[1,4].

Los DAM son aparatos intraorales que actúan sobre la vía aérea superior, de forma que adelantan la posición de la mandíbula y la lengua, por lo que aumentan el espacio retrofaríngeo[4]. A pesar de que en el último consenso nacional se aprueba su uso para los casos anteriormente citados, existen pocos estudios controlados que hayan evaluado su eficacia. El número de pacientes incluidos en estos trabajos ha sido escaso. Hay que tener en cuenta que, aunque suelen ser tratamientos bien aceptados por los pacientes, su uso no está ampliamente extendido en la práctica clínica diaria. A ello contribuye, por un lado, la dificultad de encontrar protésicos dentales con experiencia que colaboren con las unidades de sueño y, por otro, el hecho de que, en el momento actual, el tratamiento ha de ser costeado por el enfermo.

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ANATOMÍA DE LA VÍA AÉREA SUPERIOR: EFECTOS DE LOS DISPOSITIVOS ORALES

En los sujetos sanos, la vía aérea superior (VAS) se mantiene permeable durante el sueño gracias a los músculos dilatadores de la faringe (particularmente el geniogloso), ya que éstos son capaces de vencer la presión negativa ejercida por el diafragma durante la inspiración. Cuando existe un desequilibrio entre las dos fuerzas, como sucede en los pacientes con un SAHS, se produce una oclusión de la VAS[5-7]. Además de tener un paladar blando alargado, una úvula más redundante y el hueso hioides desplazado hacia una situación más posterior, estos pacientes tienen depósitos de grasa más grandes acumulados a nivel de las paredes lateral y anterior de la faringe por lo que, tanto su diámetro anterolateral como el transversal, se encuentran disminuidos, lo que produce un incremento de la resistencia de la VAS[8,9].

Los músculos dilatadores de la faringe se insertan en la pared anterior y, al tensarse, actúan sobre su eje anteroposterior, incrementando su diámetro. En los pacientes con un SAHS, a diferencia de los sujetos sanos, el eje predominante es el anteroposterior, por lo que la contracción de estos músculos no resulta eficiente para incrementar el calibre de la faringe (Fig. 1)[7,10].

Los DAM actúan principalmente sobre los músculos dilatadores de la faringe, en concreto sobre el geniogloso, el cual, al reposicionarse en una situación más anterior, produce un aumento del tono muscular, mejorando su contractilidad y aumentado el calibre de la VAS[11,12]. De manera secundaria, también ejercen su acción sobre el hueso hioides, adelantándolo, y sobre la base de la lengua, evitando su caída hacia atrás durante el sueño[13].

ESTUDIOS REALIZADOS CON DISPOSITIVOS DE AVANCE MANDIBULAR. INDICACIONES ACTUALES

Aunque el uso de los DAM está aceptado en el tratamiento de la roncopatía simple y en algunos casos de SAHS, hasta hace unos años no había estudios randomizados con casos-control al respecto y, los existentes hasta entonces, además de no estar randomizados, contaban con un tamaño muestral pequeño. De hecho, en la última revisión realizada por la Librería Cochrane, tan sólo se describen dieciséis estudios que cumplan los criterios de inclusión establecidos por ellos (ensayos aleatorios con control)[14]. Además, tanto los parámetros medidos como los modelos de dispositivos utilizados en cada uno de ellos, han sido distintos, aunque no se ha visto que este último dato se correlacione con un mayor o menor éxito terapéutico[15,16].

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ORIGINALES

Eficacia de una prótesis de avance mandibular en el tratamiento del síndrome de apneas obstructivas del sueño

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OBJETIVO: **Evaluar la eficacia de un modelo de prótesis de avance mandibular en el tratamiento del síndrome de apneas obstructivas del sueño.**

MÉTODO: **Se realizó tratamiento con prótesis de avance mandibular en 21 pacientes (20 varones) diagnosticados de síndrome de apneas obstructivas del sueño mediante polisomnografía. La edad media (DE) era de 51 (8) años, el índice de masa corporal de 30 (4) kg/m², y el índice de apnea-hipopnea/hora de 48 (17). Si el tratamiento era bien tolerado, independientemente de la respuesta clínica, se repetía el control polisomnográfico con prótesis entre 1 y 3 meses de iniciado el tratamiento. La prótesis de avance mandibular se consideró eficaz si el índice de apnea-hipopnea se reducía a < 15/h y desaparecerían los síntomas relacionados con el síndrome de apneas obstructivas del sueño.**

RESULTADOS: **Siete pacientes abandonaron el tratamiento en los primeros días de uso. Los 14 restantes (66%) toleraron bien el tratamiento, y se realizó el control polisomnográfico. En 6 de los 14 casos (43%) la prótesis de avance mandibular demostró ser eficaz en la corrección del síndrome de apneas obstructivas del sueño. En 6 pacientes más se conseguía una reducción del índice de apnea-hipopnea, sin llegar a su normalización. En los 2 casos restantes no hubo ninguna mejoría. La mejoría del índice de apnea-hipopnea no se relacionaba con el grado de gravedad del síndrome de apneas obstructivas del sueño.**

CONCLUSIÓN: **La prótesis de avance mandibular es un tratamiento eficaz para un subgrupo de pacientes con síndrome de apneas obstructivas del sueño, incluyendo algunos con índice de apnea-hipopnea elevado. Son necesarios estudios más amplios que nos permitan definir el tipo de pacientes que pueden beneficiarse.**

Palabras clave: *Síndrome de apneas obstructivas del sueño. Prótesis de avance mandibular. Dispositivos orales.*

Efficacy of a mandibular advancement prosthesis for treating obstructive sleep apnea syndrome

OBJECTIVE: **To assess the efficacy of a mandibular advancement prosthesis for treating obstructive sleep apnea syndrome (OSAS).**

METHOD: **Mandibular advancement appliances were prescribed for 21 patients (20 men) with OSAS diagnosed by polysomnography. Mean age was 51 (8) years, BMI was 30 (4) kg/m², and the apnea-hypopnea index (AHI) per hour was 48 (17). If the device was well tolerated, regardless of clinical response, polysomnography was repeated between 1 to 3 months after start of treatment. The device was considered effective if the AHI decreased to < 15/h and symptoms related to OSAS disappeared.**

RESULTS: **Seven patients withdrew from treatment after only a few days. The remaining 14 (66%) tolerated treatment well and the second polysomnogram was performed. In six of the 14 (43%), the device proved effective for correcting OSAS. In six more patients, the AHI decreased but failed to become normal. In the remaining two patients, no improvement was observed. Improvement in the AHI was unrelated to severity of OSAS.**

CONCLUSION: **The mandibular advancement prosthesis is effective for some patients with OSAS, including those in whom the AHI is high. Larger studies are needed to allow us to define the type of patients that might benefit.**

Key words: *Obstructive sleep apnea syndrome. Mandibular advancement prosthesis. Oral appliances.*

(*Arch Bronconeumol* 2000; 36: 371-376)

Introducción

El síndrome de apneas obstructivas del sueño (SAOS) es un trastorno frecuente, que afecta al 2% de las mujeres y al 4% de los varones de edad adulta[1], produciendo hipersomnolencia diurna y otros síntomas como cefaleas, cambios en el carácter y en el nivel cognitivo o impotencia. Se acompaña de complicaciones cardiovasculares, como arritmias cardíacas, infarto de miocardio y accidentes cerebrovasculares[2]. El tratamiento de elección es la CPAP nasal (presión positiva continua en la vía aérea)[3], que es eficaz y seguro, pero no siempre es bien aceptado ni utilizado a largo plazo[4].

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An Oral Elastic Mandibular Advancement Device for Obstructive Sleep Apnea

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Oral mandibular advancement devices are becoming an increasingly important treatment alternative for obstructive sleep apnea (OSA). The first aim of the study was to determine whether a new oral elastic mandibular advancement device (EMA) prevents pharyngeal airway closure during sleep in patients with OSA. The second aim of the study was to determine if the polysomnographic response to the oral mandibular advancement device was dependent on the site of airway closure. Overnight polysomnograms were performed in 28 untreated OSA subjects with and without EMA. A third polysomnogram was performed in 12 of the subjects to determine the site of airway closure without the device. Site of airway closure above or below the oropharynx was determined by measuring the respective presence or absence of respiratory fluctuations in oropharyngeal pressure during induced occlusions in non–rapid eye movement (NREM) sleep. Mean apnea–hypopnea index (AHI) was 52.6 ± 28.2 (SD) events/h without the device and 21.2 ± 19.3 events/h with the device. Nineteen subjects (68%) had at least a 50% reduction in AHI with the device. The change in AHI with the device (AHI without device − AHI with device) was directly related to the AHI without the device. All three subjects with airway closure in the lower pharyngeal airway had a greater than 80% reduction in AHI with the device. Two of the nine subjects with airway closure in the velopharynx had a similar therapeutic response. The results show the effectiveness of EMA in the treatment of OSA. The results also indicate that polysomnographic severity of OSA and the site of airway closure should not be used to exclude patients from this oral device treatment. Henke KG, Frantz DE, Kuna ST. An oral elastic mandibular advancement device for obstructive sleep apnea.

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Oral mandibular advancement devices are becoming an increasingly important treatment alternative for obstructive sleep apnea (OSA). A variety of appliances are commercially available, differing widely in design and the manner in which they alter the oral cavity. Previous studies by other investigators have tested the ability of these devices to prevent pharyngeal airway closure during sleep in patients with OSA, and report that the apnea–hypopnea index (AHI) decreases by 40 to 75% with the device (1–15). An oral mandibular advancement device has also been reported to be effective in treating upper airway resistance syndrome (16).

Recently, a new oral mandibular advancement appliance (EMA) has been developed by one of the authors (D. Frantz) for the treatment of OSA. The device consists of two plastic trays custom molded to the patient's maxillary and mandibular teeth. Elastic straps attached to the upper and lower trays pull the mandible forward. The amount of advancement can be adjusted by altering the length and elasticity of the straps. The device allows lateral, vertical, and anteroposterior movement of the mandible while advancing the mandible in a ventral and caudal direction. The first aim of the current study was to determine whether this new appliance prevents pharyngeal airway closure during sleep in patients with OSA.

While the effectiveness of nasal continuous positive airway pressure (CPAP) treatment of OSA is independent of the site of pharyngeal airway closure, studies indicate that the effectiveness of uvulopalatopharyngoplasty, a resection of soft tissue in the velo- and oropharynx, is dependent on the site of closure. Launois and coworkers (17) and Hudgel and coworkers (18) have shown that OSA patients with airway closure in the velopharynx are more likely to have an initial beneficial outcome. A recent study by Millman and coworkers (19) reported that patients with continued OSA after uvulopalatopharyngoplasty had a very favorable polysomnographic response to oral mandibular advancement device treatment. The aforementioned studies raise the possibility that the ability of an oral mandibular advancement device to prevent pharyngeal airway closure during sleep is also dependent on the site of airway closure. The second aim of the study was to determine if the polysomnographic response to EMA was dependent on the site of airway closure. We hypothesized that OSA subjects with airway closure in the lower pharyngeal airway would be more likely to respond to an oral device owing to the ventral

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