ABSTRACTS

http://dx.doi.org/10.15331/jdsm.5996

25th Anniversary Meeting of the American Academy of Dental Sleep Medicine: Denver, CO, June 9–11, 2016

POSTER #001

Longevity Of Fusion Custom Mask for Combination Therapy Treatment for OSA: Nine Year Follow-Up

Prehn RS

Restore TMJ & Sleep Therapy, The Woodlands, TX, USA; University of Texas School of Dentistry, Houston, TX, USA; Inspire Research and Education, The Woodlands, TX USA; Diplomate American Board of Dental Sleep Medicine

Introduction: The purpose of this study was to investigate the longevity of the Fusion Custom Mask (FCM) used in combination therapy to treat OSA in patients who presented to a dental sleep center. Being a new therapeutic option, it is unknown how long a FCM will last and if it is cost effective.

Methods: The FCM is a custom CPAP face mask that is fabricated from an impression of the face. This FCM is then connected to the post attached to an oral appliance. This strapless CPAP face mask features a CPAP interface with mandibular stabilization. A retrospective chart review of 75 FCM patients on combination therapy from 2006-2012 was conducted in 2015 to determine the current therapeutic disposition. All 75 patients were contacted by phone and interviewed.

Results: Current status as of 75 patients in 2015 is as follows: Unable to contact (#19 which left 56 remaining); Still wearing Custom mask #44 (78% of contacted patients); Went back to stock CPAP #5 (10%); Lost weight/ OSA resolved #3 (4%); Surgery/OSA resolved #2 (4%); Bad CPAP side effect #1 (2%); Deceased #1 (2%). Cost of 1.CPAP Mask vs 2.FCM is as follows: 1) Stock CPAP mask ($150 AirFit™ F10 Full Face Mask); Annual cost $800 (mask/tubing); 5 year cost $4150. 2) FCM ($3600); Annual cost $80.00 (tubing); 5 year cost $3650. Many of these patients with FCM were given their masks in 2006 and some every year since. That makes some of these custom masks over 9 years old. Longevity is clearly established in this survey. A few of these patients had to have their mask relined as they lost significant weight that caused leakage. But all 44 patients still wearing the mask were satisfied and in treatment. The actual life span of these masks have yet to be determined since they are still functioning after 9 years in some of these patients. The longevity of this device also makes the initial cost of the device comparable to stock CPAP mask when considered how long this mask lasts. The hose replacement is the only annual cost to the CM. Then the consideration that many of these patients remain in therapy saving lives and improving the health of these patients is a savings yet to be determined.

Conclusions: Not only is a CM effective in the long term in combination therapy, especially those on the severe end of the spectrum, but is also cost effective. The CM should be considered when other therapeutic methods of treating OSA have failed or when CPAP pressures or the CPAP mask are intolerable to the patient.

POSTER #002

About 45 Cases of Application of SOMNOSNORE Mandibular Advancement Devices in Snoring Treatment

Besnainou G

Lariboisière Hospital, Paris

Introduction: The mandibular advancement appliances used today in France represent devices with an adjustment system which adapts the mandibular propulsion to the patient's symptoms, but this system has the disadvantage of taking up space in the mouth. My experience of over 500 mandibular advancement devices (MAD) used in SAS or snoring treatment showed that snoring disappears since the first titration. The purpose of this study was to find out whether, in snoring, the good initial titration could prevent us from using titratable mandibular advancement splints mm/mm, which would simplify and ease their usage and thereby improve patient's comfort.

Methods: A single-center prospective study of 45 patients, from November 2014 to June 2015, has been carried out. Demographics: 25 men and 20 women. Average age: 43 years [24-72]. MAD Type: The SOMNOSNORE MAD, manufactured by Somnomed laboratory, was used for this study. It is identical to the Somnodent MAD but has no control cylinder. Contrariwise, this MAD is supplied with a top gutter and two bottom gutters: the first one with the desired titration and the second one with a supplementary protrusion of 2 mm. Titration: The initial titration was of 70% of the maximum active propulsion (MAP). Measuring of the titration was carried out with a George Gauge. This easy to use tool allows the most precise measurement of the progress to be made, and moreover, the protrusion is done exactly in the position requested by the recording range.

Conclusions: In total, among 44 patients, which completed the study, 43 subjects stopped snoring. The use of the SOMNOSNORE MAD allowed to achieve the full result in snoring treatment. This MAD is easy to produce, and, if the initial titration is well performed, the result is immediate and the follow-up is simplified. In future, the oral appliances with integrated control system could probably be replaced by less bulky devices with preset and easily interchangeable gutters to fit the patient's symptomatology.

POSTER #003

Effects of Sedation on Breathing in Patients Undergoing Dental Operation

Kohzuka Y, Isono S

Department of Anesthesiology, Graduate School of Medicine, Chiba University

Introduction: Sedation for dental treatments is often applied to patients with strong anxiety and vomiting reflex, and undergoing major dental surgeries. Severe cardio-respiratory complications including deaths were reported under dental sedations. Under sedation which depresses the upper airway functions such as airway maintenance and airway protective reflexes, use of water during the treatment may block oral breathing and wider mouth opening may impair nasal airway patency. Furthermore, the water may be aspirated and induce the upper airway reflexes. We therefore tested a hypothesis that adverse respiratory events occur during dental sedation even in healthy adults.

Methods: Six adult patients scheduled for dental extraction under dental sedation were enrolled in this study (2 males and 4 females). In addition to a routine cardiorespiratory monitor, a type3 portable sleep apnea monitor was used to measure breathing through the nose, respiratory efforts, and oxygen saturation before and during the sedation. Conscious sedation was targeted by bolus intravenous injection of midazolam (1mg), bolus (10 mg) and continuous infusions of propofol (1-3mg/kg/hour). We analyzed the measured tracings during sedation to identify respiratory adverse events such as apnea, hypopnea, desaturation, sigh and cough reflex.

Results: Participants were middle-aged (47 ± 12 yrs) and non-obese (24 ± 4 kg/m2) except one with BMI 31 kg/m2. Dental extraction was successfully accomplished in all participants without apparent adverse complications (57 ± 24 minutes). Desaturations occurred in association with apnea or hypopnea (12 ± 14 episodes/hour), and were more common in patients without oxygen administration (n = 2) than those receiving 3 liter/min oxygen (n = 4). Apnea and hypopnea occurred more frequently than the desaturation episodes (14 ± 12 episodes/hour, 23 ± 20 episodes/hour, respectively). Recovery from apnea and hypopnea often occurred in association with a coughing (20 ± 25 episodes/hour) or sigh (11 ± 5 episodes/hour) event. Interestingly, there is a positive correlation between the apnea/hypopnea index and frequency of cough reflex ($r = 0.89$, $P = 0.017$).

Conclusions: The results support the hypothesis and there were many abnormal respiratory events during dental sedation for healthy adults.

Support: This study was supported by Japanese grant-in-aid (4390363) from the Ministry of Education, Culture, Sports, Science and Technology, Tokyo, Japan.

POSTER #004

No Increase in Sleep Bruxism or Sustained Orofacial Muscle Activity during Sleep in Mild Traumatic Brain Injury Patients: A Controlled Study

Suzuki Y, Khoury S, Giguere JF, Denis R, Lavigne G

Surgery department, Hôpital du Sacré-Cœur de Montréal and Faculté de médecine dentaire, Université de Montréal, Canada

Introduction: Traumatic brain injury (TBI) is an acute condition caused by mechanical energy transfer to the head by an external physical force, resulting from sports, vehicle accidents, assaults, falls, etc. About 15% of mild TBI (mTBI) cases lead to headache, widespread pain, or various sleep disorders (e.g., insomnia, apnea). However, although bruxism and dystonia are occasionally reported after TBI, it is unknown whether mTBI also leads to sleep bruxism (SB). The aim of this study was to assess the frequency and severity of orofacial muscle activity in mTBI patients compared to control subjects at one month post-trauma.

Methods: Polysomnography (PSG) recordings (EEG, EOG, ECG, EMG) were conducted on the chin/suprahyoid, right masseter, and leg/anterior tibialis of subjects for two consecutive nights. Nineteen mTBI patients were recruited at our trauma center at one month post-trauma and compared to 16 controls without sleep bruxism or pain. The first night was for habituation and the second was for data analysis of: 1) rhythmic masticatory muscle activity (RMMA), a biomarker of SB, detected in the masseter EMG and scored according to International Classification of Sleep Disorders (ICSD-3, 2014) criteria; and 2) muscle tone of the chin, masseter, and anterior leg/tibialis, calculated as the root mean square amplitude of 20 stable epochs without movement or arousal per sleep stage. Group differences were compared using Student's t-test.

Results: PSG analysis revealed that mTBI patients slept significantly less than controls (6.7 vs 7.5hrs) and had lower sleep efficiency (89.8 vs. 94.8%) and longer sleep latency (22.0 vs. 9.3min), although differences were within normal clinical range ($P < 0.05$ for all comparisons). 1) For SB analysis, the sample included 19 mTBI patients (M:10, F:9; mean age: 37yrs) and 16 controls (M:6, F:10; 28yrs). No significant between-group differences were found in the frequency of RMMA SB-related outcome measures (e.g., RMMA index of 1.0 and 0.8 for mTBI and controls, respectively; NS; $P = 0.55$). 2) For the sustained muscle tone analysis, the sample included 16 mTBI patients (M:7, F:9; 38yrs) and the same 16 controls. Although chin and masseter muscle tone did not differ between groups, mild TBI patients showed higher anterior tibialis muscle tone for each non-REM sleep stage ($P < 0.05$), and slightly higher in wake time before sleep and REM sleep ($P = 0.06$).

Conclusions: Patients with mTBI showed no evidence of SB or increased orofacial muscle tone. However, increased leg muscle tone in the non-REM sleep of TBI patients may reflect [a hyperarousal state] (Khoury S, J Neurotrauma 2013).

Support: Study supported by the FRQS Pain Res Network and Canada Research Chair (GL).

POSTER #005

Is It Possible to Predict the Sleep Apnea Severity and Anatomical Pathophysiology by the Maxillofacial CT in Japan?

Arisaka T[1], Chiba S[1], Yagi T[1], Chiba S[1,2], Tonogi M[3], Ota F[1]

[1]Ota Memorial Sleep Center, Sleep Surgery Center, Kanagawa, Japan, [2]Department of Otorhinolaryngology, Jikei University School of Medicine, Tokyo, Japan, [3]Department of Oral and Maxillofacial Surgery, Nihon University School of Dentistry, Tokyo, Japan

Introduction: Obstructive sleep apnea (OSA) is known as a social problem in Japan. It develops a cardiovascular disease, a traffic accident by daytime sleepiness and more by sleep breathing disorders. It is necessary to Polysomnography(PSG) testing in the diagnosis of OSA. However all facility can't be PSG testing. On the other hand, Japan has CT scanners by the highest number per capita. And It is conceivable that the frequency of the CT imaging is large number. Therefore the CT imaging has been investigated whether it is possible predict the OSA severity and is it useful to understand anatomical pathophysiology of OSA.

Methods: We enrolled consecutive 451 OSA patients who diagnosed by PSG and got consent to CT imaging, from April 2014 to March 2015 in Ota memorial sleep center (Kanagawa, Japan). We measured detail of maxillofacial structure from three-dimensional construction by DICOM data of CT. Each measurement, clinical findings and patient background was evaluated using multiple regression analysis.

Results: In the group of male were 371 cases. Independent predictors were the hyoid position, BMI, mandibular body length, angle of mandible, size of tonsil, facial axis, soft palate length and thickness, anteroposterior length of cranium and Lateral length of maxilla ($R^2 = 0.448$). In the group of female were 80 cases. Selected independent predictors were the BMI, hyoid position, size of tonsil, age and anteroposterior length of cranium ($R^2 = 0.523$). Prediction equation that was created from the cephalometric analysis of the same group of male were less accuracy ($R^2 = 0.356$).

Conclusions: By using a prediction equation created from the data of the maxillofacial CT, it was possible to predict the OSA severity with high accuracy. And also, we can understand anatomical pathophysiology of each case in Japanese male. In the future, we have the propose of standardization of CT analysis in Japan from these data.

POSTER #006

The Prevalence of General Dentists who Screen for Obstructive Sleep Apnea

Long A, Chiang H, Best A, Leszczyszyn D

VCU School of Dentistry

Introduction: Obstructive sleep apnea (OSA) is a common condition involving up to 17% of adult males and 9% of adult females, many of which go undiagnosed for prolonged amounts of time. This fact is likely due to the lack of screening methods or overall minimal screening considerations by health care professionals. The adult population visits a general dentist up to 25% more often than a primary care physician. In order to provide greater awareness and improved outcomes of sleep apnea, a knowledge of general dentist involvement of OSA detection is imperative in aiding diagnosis and subsequent treatment.

Methods: A brief, 12-item questionnaire was electronically sent to one-thousand General Dentists across the United States. The questionnaire consisted of a short demographic section followed by a series of questions regarding screening methods and preferences for OSA.

Results: Seventy-five dentists responded to the questionnaire. According to the results, approximately 70% of general dentists report participation in some type of screening for OSA. Only 40% of those who do screen report routine screening for at least 8 out of 10 patients. There are three main modalities to screen for OSA: patient interview, written questionnaire, and identification of anatomical parameters. The patient interview modality has the most frequent utilization at 70% of responders with most all identifying snoring and daytime fatigue. Next, is the identification of anatomical parameters at 53% of responders, in which most all examine tonsils/adenoids and neck circumference. Last, is the written questionnaire at only 38% of responders, with the most popular being the Epworth questionnaire. Nearly half of those who routinely screen for OSA utilize the patient interview as their preferred screening modality. On a scale from 1 – 5 (1 = uncomfortable, 5 = confident), dentists were asked to rate their confidence in screening for OSA. The majority (53%) of responders rated themselves 3 or less. The results demonstrate a well-rounded sample of the General Dentist population including representation of 28 states with at least one responder and 33 unique dental school training representation. The city size the dentists practice in is also represented very evenly, ranging from less than 20,000 to more than 500,000. Dentists who responded represented a broad range of dental experience (5-30+ years), while nearly half (48%) of responders reported over 30 years practicing dentistry. Roughly all responders (98%) reported practicing general dentistry in a private practice. 88% of those who suspect patients with OSA refer to physicians for evaluation.

Conclusions: The results show that 28% of dentists screen for OSA in at least 8 out of 10 patients. The patient interview is the widely preferred screening modality, followed by a written questionnaire and identification of anatomical parameters. The majority of general dentists report some level of discomfort in confidently screening for OSA. This data demonstrates the need for general dentists to become more aware and better trained to help accurately and confidently screen for OSA.

POSTER #007

The Prevalence of Pediatric Dentists who Screen for Obstructive Sleep Apnea

Reddy NG[1], Chiang HK[1], Best AM[1], Leszczyszyn DJ[2]

[1]Schools of Dentistry and [2]Medicine, Virginia Commonwealth University

Introduction: Obstructive Sleep Apnea (OSA) is a sleep disorder characterized by repeated episodes of upper airway obstruction for more than 10 seconds while sleeping. This results in pauses or apneas in breathing, which leads to interruptions in sleep. OSA affects 1-10% of children, and has significant sequelae when left untreated. It is estimated that children visit their dentist four times more often than their primary care physician, which provides a greater opportunity for pediatric dentists to screen for OSA. While there is ample research available on treatments and screening methods, there is limited research available on the prevalence of screening among pediatric dentists.

Methods: A brief questionnaire was electronically sent to approximately 5,500 Pediatric Dentists who are members of the American Academy of Pediatric Dentistry using REDcap.

Results: 448 pediatric dentists responded to the questionnaire. According to the results, 63% of pediatric dentists report participation in some type of screening for OSA but only 29% of those who do screen report routine screening 100% of their patients. There are three main modalities to screen for OSA: patient interview, written questionnaire, and identification of anatomical parameters. The patient interview modality has the most frequent utilization at 55% of pediatric dentists with most identifying snoring, daytime fatigue, and mouth breathing. Next, is the identification of anatomical parameters at 53%, in which most all examine tonsils/adenoids size. Last, is the written questionnaire at only 5%. Nearly half of those who routinely screen for OSA utilize the patient interview as their preferred screening modality. Only 7% of pediatric dentists provide treatment for their patients with OSA. Of the 7%, 76% focus on providing treatment for both the maxilla and mandible with the most common appliance being the rapid palatal expander. On a scale from 1 – 5 (1 = uncomfortable, 5 = confident), dentists were asked to rate their confidence in screening for OSA. The majority, 71% of pediatric dentists, rated themselves 3 or less. The results demonstrate a well-rounded sample of the pediatric dentist population including representation of 48 states and 57 dental schools. The city size the dentists practice in is also represented very evenly, ranging from less than 20,000 to more than 500,000. Dentists who responded represented a broad range of dental experience (5-30+ years). Approximately 90% of those who suspect patients with OSA refer to physicians for further evaluation.

Conclusions: The results show that more than one third of pediatric dentists do not screen their patients for OSA, which is significant portion of the pediatric population. Furthermore, the majority of dentists report some level of discomfort in confidently screening for OSA and 93% do not provide treatment for OSA. This data demonstrates the need for pediatric dentists to become more aware and better trained to help accurately and confidently screen for OSA.

POSTER #008

The Influence of the Amount of Degree of Vertical Opening in the Design of Mandibular Advancement Device MAD for Obstructive Sleep Apnea Patients

Mayoral P, Zarate D, Duran S, Borreguero DG, Cano I

Instituto del Sueño Madrid

Introduction: Opening of the bite occurs during MAD treatment as all appliances have a given thickness causing vertical jaw displacement. Increased vertical mouth opening has an adverse effect on upper airway patency in the majority of OSA patients. The purposes of this study were to estimate the effect of vertical opening in the mandibular advancement and to evaluate the influence of the amount of vertical opening in the efficacy of MAD for obstructive sleep apnea (OSA) patients.

Methods: From the patients who were diagnosed as OSA by polysomnographic study at Instituto del Sueño de Madrid from January 2009 to February 2013, 225 patients who chose MAD as treatment option were included in this study. All the patients´ data including clinical records and polysomnographic studies (both pre- and post-treatment) were reviewed and analyzed. Two degrees of vertical opening 2 and 5 mm were studied. Maximum protrusion and maximum retrusion was measured in each patient with George Gauge. The statistical analysis was made with the Wilcoxon signed-rank test for paired data.

Results: Mandibular total advance was 1.42 mm longer with 2mm compared with 5mm vertical opening (2mm 12,92 vs 5mm 11,5). 66% of maximum protrusion was 0,945mm longer for 2mm vertical opening (2mm 8,604 vs 5mm 7,659).

Conclusions: Total advance allowed 1,5mm more advance and 66% of maximum protrusion allowed 1mm with 2mm vs 5mm vertical opening. Amount of bite opening should be minimized to improve patient tolerance and increase the beneficial effect on upper airway dimensions. MAD was effective treatment option for the OSA patients regardless of severity. For the prevention of potential dental complications, the amount of vertical opening should be considered at the time of MAD treatment.

References: Pitsis AJ, Darendeliler MA, Gotsopoulos H, Petocz P, Cistulli PA. Effect of vertical dimension on efficacy of oral appliance therapy in obstructive sleep apnea. Am J Respir Crit Care Med. 2002;166:860–4. Vroegop AV, Vanderveken OM, Van de Heyning PH, Braem MJ. Effects of vertical opening on pharyngeal dimensions in patients with obstructive sleep apnoea. Sleep Med. 2012;13:314–6. Sutherland K, Vanderveken OM, Tsuda H, et al. Oral Appliance Treatment for Obstructive Sleep Apnea: An Update. Journal of Clinical Sleep Medicine 2014;10:215-227.

POSTER #009

Mandibular Advancement Splint as a Comparable Treatment to Nasal Continuous Positive Airway Pressure in Patients with Positional Obstructive Sleep Apnea

Takaesu Y[1], Tsuiki S [2,3,4], Kobayashi M[2,3,4], Komada Y[2,3,4], Inoue Y[2,3,4]

[1]Department of Psychiatry, Tokyo Medical University, Tokyo, Japan; [2]Japan Somnology Center, Institute of Neuropsychiatry, Tokyo, Japan; [3]Department of Somnology, Tokyo Medical University, Tokyo, Japan; [4]Foundation of Sleep and Health Sciences, Tokyo, Japan

Introduction: In clinical settings, many patients with obstructive sleep apnea (OSA) experience more severe OSA while asleep in the supine position than in the lateral position. Oksenberg *et al.* (2014) reported that these individuals called positional OSA is present in approximately 50%-60% of OSA patients who undergo polysomnography. Chung *et al.* (2010) interestingly suggested that positional OSA patients responded better to a mandibular advancement splint (MAS) than patients with non-positional OSA. Since positional OSA is likely to be a common OSA phenotype that can be detected by diagnostic polysomnography, MAS treatment for positional OSA patients may result in increased treatment efficacy and offer a patient-tailored approach to OSA. Accordingly, we hypothesized that the efficacy of an MAS is comparable to that of nasal continuous positive airway pressure (nCPAP) when used in patients with positional OSA.

Methods: The study protocol was approved by the ethics committee of the Foundation of Sleep and Health Sciences. Amongst patients diagnosed with OSA at a single sleep center from January 2008 to May 2014, male subjects with moderate OSA were recruited and stringently categorized as having positional OSA when the ratio of their lateral apnea-hypopnea index (AHI) to supine AHI was 0.5 or less, their lateral sleep time was longer than 60 minutes, and their lateral rapid eye movement sleep time was longer than 10 minutes. Treatment efficacy in terms of AHI was compared between positional OSA subjects with an MAS (N = 34) and those with nCPAP (N = 34) by the unpaired *t*-test after matching for age, body-mass index, and baseline AHI. A *p*-value of less than 0.05 was considered to indicate a statistically significant difference between groups.

Results: There were no significant differences in age (p = 0.81) or in body-mass index (p = 0.07) between the 2 treatment groups. Also there were no significant differences in baseline AHI (MAS : nCPAP = 20.6 ± 3.9/hr : 21.3 ± 1.7/hr, p = 0.35) or in follow-up AHI (MAS : nCPAP = 4.7 ± 3.5/hr : 3.4 ± 3.7/hr, p = 0.12) between the groups. Hence the AHI was lowered with MAS to the same extent as nCPAP.

Conclusions: This is the first demonstration that an MAS is as efficacious as nCPAP for positional OSA patients. We conclude that MAS treatment for this specific phenotype, positional OSA, may be a promising patient-tailored and first-line approach to OSA. The information on positional dependency should also be useful for determining the type of treatment to use immediately after OSA diagnosis.

POSTER #010

Long Term Evaluation of Occlusal Changes during Treatment with Mandibular Advance Device for Obstructive Sleep Apnea: Preliminary Report

Mayoral P, Borreguero DG, Cano I, Mesa JI, Durán S

Instituto del Sueño Madrid

Introduction: The purpose of this study was to evaluate the magnitude and progression of dental changes associated with long-term mandibular advancement device (MAD) treatment of obstructive sleep apnea (OSA).

Methods: Prospective study of adults treated for primary snoring or mild to severe OSA with MAS for 6 months, 2, 4 and 8 years. The series of dental casts of patients were analyzed with a 3Shape 3D Orthodontic analysis for changes in overbite, overjet, dental arch crowding and width, and inter-arch relationships. The progression of these changes will be determined and initial patient and dental characteristics will be evaluated as predictors of the observed dental side effects of treatment. From the patients who were diagnosed as OSA by polysomnographic study at Instituto del Sueño de Madrid from January 2015 to June 2015, 245 patients who chose MAD as treatment option were included in this study. All the patients´ data including clinical records and polysomnographic studies (both pre- and post-treatment) were reviewed and analyzed. A total of 245 patients (average age at start of treatment: 45.4 ± 9.8 years, 175 males) were included in this study. The average treatment length was 6.1 ± 1.4 months.

Results: In the preliminary 6 months interval evaluated there was a minimal reduction in the overbite (0.1 ± 0.05 mm), overjet (0.2 ± 0.6 mm. A corresponding increase of mandibular intercanine (0.1 ± 0.4 mm) and intermolar (0.1 ± 0.3 mm) width.

Conclusions: After an average preliminary observation period of 6 months, no clinically significant changes in occlusion were observed. The monoblock MAD used had no dental side effects. Further evaluation in time will be made 2, 4 and 8 years treatment follow-up. MAD was effective treatment option for the OSA patients regardless of severity. For the prevention of potential dental complications, a stable occlusion in advance given by the device should be considered at the time of MAD treatment.

References: Pliska BT, Nam H, Chen H, Lowe AA, Almeida FR. Obstructive sleep apnea and mandibular advancement splints: occlusal effects and progression of changes associated with a decade of treatment. J Clin Sleep Med. 2014;10:1285–91.
Marklund M, Franklin KA, Persson M. Orthodontic side-effects of mandibular advancement devices during treatment of snoring and sleep apnoea. Eur J Orthod. 2001;23:135–44
Rose EC, Staats R, Virchow C, Jonas IE. Occlusal and skeletal effects of an oral appliance in the treatment of obstructive sleep apnea. Chest. 2002;122:871–7.

POSTER #011

Effects of a Novel Mandibular Advancement Device on AHI and Snoring in Patients with Obstructive Sleep Apnea: A Pilot Study

Hart C[1], Lavery D[2], Czyniewski S[3], Beer F[3]

[1]Breathing Assist Solutions, [2]National Dental Care, [3]Mobius Medical

Introduction: This prospective, single-arm, single-centre pilot trial was performed to establish the safety and efficacy of the Oventus device in treating obstructive sleep apnea (OSA) and snoring. The device is designed to provide mandibular advancement, and provide a passage from the front to rear of the mouth within the device for breathing. The method of bypassing any obstructions of the soft palate and nasal cavity, could provide an alternative treatment option for all patients, especially those with nasal congestion.

Methods: The trial consisted of 30 participants with OSA, diagnosed by baseline ambulatory polysomnography (PSG). All PSGs in the trial were scored independently by one RPSGT. Nasal congestion was measured at baseline. Additionally, subjective sleep questionnaires were completed pre and post treatment. The protocol design included a baseline PSG and dental requirements, fabrication and delivery of the appliance. Following 3-5 weeks of acclimatisation, a PSG was performed with the device in-situ. As per the protocol, the device could be manipulated increasing the mandibular protrusion (max 85%) two more times. Hence three follow-up PSGs with the device in-situ were permitted. Participants with a $\geq$50% reduction in AHI were classed as responders.

Results: Of the 30 participants, 29 completed at least one follow-up PSG to assess the level of titration. One participant withdrew prior to completing any follow-up PSGs. On average the AHI decrease by 62.5% from baseline (m = 41.0, sd = 26.4) to the final PSG (m = 16.2, sd = 15.4). The mean difference was 25.7 (sd = 16.8, $p < 0.001$). Overall 22 (75.9%, 95%CI 59%-92%) participants were responders, which is statistically significant. Subgroup analysis was performed by nasal congestion (NC; n = 17) vs. no congestion (NNC; n = 12). The median percentage difference in AHI was 69.6%% vs. 63.2%% respectively for NC and NNC. Similarly, the proportion of responders was 76.5% vs. 75.0%. Although the study wasn't powered to detect a statistical difference - it appears those with nasal congestion can expect similar decreases in AHI and response rates. At baseline, the median percentage of time < 90%$Sp0_2$ was 6.2% for responders vs. 2.1% for non-responders. After the final PSG with the device, the time < 90%$Sp0_2$ was reduced < 1% of total sleep time for all participants. This decrease, following treatment, appears independent of changes in AHI or nasal congestion. On treatment all participants spend < 1% of time below 90% oxygen saturation.

Conclusions: In summary, this device is statistically significant in treating OSA. Additionally participants with nasal congestion responded in a similar way to those without nasal congestion, which supports a hypothesis that this device could be successfully used in patients with nasal congestion, which will be further analysed in future trials. An unexpected finding was that there was a reduction in the amount of time spent below 90% oxygen saturation irrespective of nasal congestion or AHI response.

POSTER #012

Effects of Biomimetic Oral Appliance Therapy on Epworth Scores in Adults with Obstructive Sleep Apnea

Liao F[1], Singh GD[2]

[1]Whole Health Dental Center, Falls Church, VA, [2] BioModeling Solutions, Inc., Beaverton, OR

Introduction: Biomimetic oral appliance therapy (BOAT) differs from conventional mandibular advancement devices (MADs) that are currently deployed for the management of mild and moderate cases of obstructive sleep apnea (OSA) in adults, as it attempts to avoid unwanted tooth movements, temporo-mandibular joint issues and undesired facial profile changes that may be associated with long-term MAD use. Indeed, BOAT aims to correct the upper airway through midfacial redevelopment followed by mandibular correction, which may resolve OSA in adults. In this investigation, we test the hypothesis that perceived daytime sleepiness in adults with mild to moderate OSA can be addressed without primary mandibular advancement using BOAT.

Methods: In this preliminary study, we included 13 consecutive adults aged > 21yrs. that had been diagnosed with mild to moderate OSA, following an overnight sleep study that had been interpreted by a board certified sleep physician. Prior to treatment each subject that participated in this pilot study completed an Epworth sleepiness scale (ESS) questionnaire. Each subject was treated by a dentist with advanced training in dental sleep medicine. At each monthly follow-up visit, examination for progress and adjustments of the devices were performed to optimize their efficacy. Post-treatment, each subject completed a follow-up ESS questionnaire. The mean ESS scores of the study sample was calculated prior to and after BOAT. The findings were subjected to statistical analysis, using paired t-tests.

Results: There were 7 females and 6 males that were included in this preliminary study. The mean age of the sample was 50 yrs. ± 12. Prior to treatment the mean ESS score of the study subjects was 8.2 ± 6. A further follow ESS questionnaire was done at a mean of 29.3 mos. ± 21.5 after BOAT. At this time, the mean ESS score decreased significantly ($p < 0.05$) to a value of 4.2 ± 3.6 after BOAT, which represents a fall in the mean ESS score by 51.4% for the study sample.

Conclusions: BOAT may be a useful method of managing adults with OSA who are seeking an alternative to long-term CPAP and MAD use. Although ESS is a discriminating test of daytime sleepiness, further data on specificity and sensitivity on these initial findings will be obtained using a larger sample size in long-term future studies.

POSTER #013

Prevalence of Subjective and Objective Residual Excessive Sleepiness During Successful Mandibular Advancement Device Therapy for Obstructive Sleep Apnea

Verbruggen AER[1,8], Dieltjens M[1,2,8], Wouters K[5], De Volder I[4,5,6], Verbraecken JA [3,6,8], De Backer WA[3,6,8], Van de Heyning PH[1,3,8], Braem M. J[2,8], Vanderveken OM[1,3,8]

[1]Department of Ear Nose Throat, Head and Neck Surgery, [2]Special Care Dentistry, [3]Multidisciplinary Sleep Disorders Centre, [4]Neurology, [5]Psychiatry, [6]Pulmonary Medicine and [7]Scientific Coordination and Biostatistics - Antwerp University Hospital (UZA), Antwerp, Belgium; [8]Faculty of medicine and health sciences - University of Antwerp, Antwerp, Belgium

Introduction: A mandibular advancement device (OAm) effectively reduces the apnea-hypopnea index (AHI) in patients with obstructive sleep apnea (OSA). Some patients, however, show little or no improvement in their daytime sleepiness with OAm, despite a significant reduction in AHI. Little is known about the prevalence of such residual excessive sleepiness (RES) despite effective OAm treatment. We aimed to determine the prevalence of subjective and objective RES in patients treated with a titratable custom-made duobloc OAm in a fixed protrusion of 75% of the maximal mandibular protrusion.

Methods: A prospective prevalence study was performed collecting data from 70 OSA-patients (men/women ratio 59/11; age 48 ± 10 years; body mass index 28 ± 3 kg/m², baseline Epworth Sleepiness Score (ESS) 9 ± 5 and baseline AHI 19 ± 12/h) undergoing OAm treatment. All patients underwent full-night polysomnography (PSG) with ESS scoring before starting and after 3 months of treatment, each time followed by multiple sleep latency tests (MSLT). Subjective and objective daytime sleepiness were assessed using the ESS and MSLT, respectively. Subjective RES is defined as a score on the ESS of ≥ 11/24, mild objective RES as a mean MSLT score < 10 minutes and pathological objective RES as a mean MSLT score < 5 minutes.

Results: Out of 70 patients, 33 patients showed success with OAm as compared to baseline PSG, defined as a "decrease in AHI ≥ 50% or AHI < 5/h". Despite this success, 6 out of 33 patients (18%) showed subjective RES, based on an ESS ≥ 11/24. Eleven out of 33 patients (33%) demonstrated mild objective RES (mean MSLT score < 10 minutes) whereas 2 out of 33 patients (6%) had pathological objective RES with mean MSLT scores < 5 minutes. A combination of subjective and mild objective RES was found in 4 out of 33 patients (12%) whereas 2 (6%) out of 33 patients showed a combination of subjective and pathological objective RES. Twenty out of 33 patients (61%) showed no subjective or objective RES when successfully treated.

Conclusions: Based on subjective and objective data, RES under OAm therapy showed a prevalence ranging from 6 to 33%, depending on the used definition.

Support: The study was funded by a 3 year grant of the Flemish government agency for Innovation by Science and Technology (IWT-090864).

POSTER #014

A New Oral Appliance Titration Protocol using the MicrO2 Sleep Device and Mandibular Positioning Home Sleep Test

Vranjes N, Bishop E, Edgerton B, Topor Z, Bruehlmann S, Kuhns D, Charkhandeh S, Remmers J

University of Alberta

Introduction: A new oral appliance and titration protocol was evaluated for treatment of obstructive sleep apnea based on efficacy, titration efficiency and patient preference. The goal of this study was to show that with a well-qualified target position for efficacious treatment, patients can be treated quickly, with few titration steps, and tolerate 1mm advancements using a comfortable, lingual-less sleep device. The MicrO2 Sleep Device by Microdental Laboratories (Dublin, CA) is the first CAD/CAM manufactured appliance with sets of upper and lower trays milled from control cured grade PMMA. Combinations of the sets of trays provide for a titration protocol that protrudes the mandible to a treated position.

Methods: A mandibular positioning home sleep test (mpHST) developed by Zephyr Sleep Technologies (Calgary, AB) was used to automatically advance the patient's mandible in response automatically detected respiratory events during a home sleep study to select patients that would be successful with oral appliance therapy and to provide a predicted efficacious mandibular position (target position, or PEMP). All participants (n = 50; AHI > 10 hr^{-1}; BMI < 45kg/m²) received the mpHST in the home for a 2-3 night study and a binary prediction of outcome. With a target provided by the mpHST and range of motion (ROM) measured by the dentist, a specific MicrO2 series were made for all participants. The design was based on a goal of 1mm increments from the target to maximum. The patient was set immediately to the target position (or less than target at the discretion of the dentist). If treatment was unsuccessful as determined by HST (Remmers recorder, Sagatech), the position was advanced in 1-2 mm increments toward the maximum. Patients were classified a therapeutic success if they reached less than 10 events per hour and a 50% reduction from their baseline.

Results: Preliminary data included 31 males and 5 females, with a mean age of 48 years and BMI of 33 kg/m². Overall, 71% were treated by the MicrO2. By the mpHST test, 58% of patients were predicted to be successfully treated with OA therapy (predicted responders) and all of these were successfully treated by the Micr02 (PPV = 100%). Of the predicted responders, 81% were treated at target and did not require further protrusion. The remaining 4 subjects were successfully treated within 1-4 titration steps using 1mm advancements. All participants with targets less than 90% of ROM accepted their target immediately, targets > 90% were advanced in 1 mm increments to their target within an average of 33 days. Continued titration resulted in 48% of predicted responders achieving an AHI < 5. Further, 24% of predicted responders had severe OSA (AHI > 30) and 40% of these patients were treated to an AHI < 5 by the MicrO2.

Conclusions: The mpHST test enabled immediately effective treatment for the majority of patients with the MicrO2 and the remaining patients achieved treatment in 1 mm adjustments.

POSTER #015

A Mandibular Positioning Home Sleep Test Prospectively Predicts Outcome of Oral Appliance Therapy for OSA Using Retrospectively Derived Decision Criteria

Remmers J[1,2], Zareian A[1,2], Topor Z[1,2], Grosse J[2], Vranjes N[2], Bruehlmann S[2], Charkhandeh S[2]

[1]University of Calgary; [2]Zephyr Sleep Technologies, Calgary, Alberta, Canada

Introduction: Because of the inconsistent efficacy of oral appliance therapy (OAT) in treating OSA, efficient use of this therapy requires for patient selection for the therapy. We have previously evaluated the accuracy of a mandibular positioning home sleep test (mpHST) in making such selection. The present study evaluates possible improvement in selection accuracy made possible by using new decision criteria derived from our experience in the previous study.

Methods: We have carried out two clinical trials using a 2-3 night mpHST in which a computer positions the mandible in response to observed respiratory events. All participants (ODI > 10 hr^{-1}; BMI < 40kg/m^2) received the mpHST and a custom, mandibular protruding oral appliance. Decision criteria applied to the mpHST results yielded a binary prediction of therapeutic outcome. The first trial (n = 122; SomnoMed G2 appliance) used decision algorithms derived from a pilot study. The second trial (n = 28; MicroDental Laboratories, MicrO2 appliance) prospectively used new algorithms derived from machine learning analysis of the results of the first study. Each mpHST supplied a predicted efficacious mandibular position (PEMP). Analysis was completed using both apnea-hypopnea index ($AHI_{4\%}$) and oxyhemoglobin desaturation index ($ODI_{4\%}$), and < 10 events per hour was taken to indicate successful therapy with the custom OA.

Results: Predictive accuracy of the mpHST using either outcome measure was as follows: From trial #1 to trial #2, $AHI_{4\%}$ sensitivity increased from 0.78 to 0.88, specificity increased from 0.62 to 0.83, positive predictive value increased from 0.83 to 0.88, negative predictive value increased from 0.55 to 0.83, error rate decreased from 0.27 to 0.14, and success rate decreased from 0.70 to 0.57. From trial #1 to trial #2, $ODI_{4\%}$ sensitivity increased from 0.78 to 0.80, specificity increased from 0.81 to 1.00, positive predictive value increased from 0.94 to 1.00, negative predictive value increased from 0.50 to 0.67, error rate decreased from 0.21 to 0.14, and success rate decreased from 0.79 to 0.71. Predictive accuracy for PEMP decreased from 91% to 81% from trial #1 to trial #2.

Conclusions: Each index of predictive accuracy, except PEMP, improved in trial #2 compared to trial #1, and the overall error rate decreased from 27% ($AHI_{4\%}$) or 21% ($ODI_{4\%}$) to 14%. The mpHST provides a robust prediction of OAT success.

POSTER #016

A Retrospective Study of Dental Records of Patients Treated of Obstructive Sleep Apnea who Preferred Oral Appliance Instead of Continuous Positive Air Pressure

Barbosa DF[1], Ferreira LDB[2], Panhan AC[2], Alves MC[3], Berzin F[2]

[1]DFB & Associados Ltda; [2]FOP-UNICAMP; [3]ESALQ-USP

Introduction: Obstructive sleep apnea (OSA) is a chronic disorder and effective long-term treatment is necessary to prevent associated health risks. OSA is associated with higher levels of excessive daytime sleepiness (EDS), attributed to several factors such as increased arousal index (AI) and apnea hypopnea index (AHI) which can increase cardiovascular risk and affect the quality of sleep. The two most common therapies used to treat OSA are 1) continuous positive air pressure (CPAP), standard treatment which is highly efficacy, but has limitations, with suboptimal patient acceptance and adherence rates, which in turn obviates the desired health benefits. 2) The oral appliance (OA), alternative treatment where the mandibular advancement splint is the most commonly used. Patients often report preferring OA to CPAP therapy. Such therapies contribute to improving the patient's health.

Methods: A retrospective study of dental records of 14 patients with OSA, middle-aged and body mass index (BMI) 29.67 (5.17). Three polysomnography tests are used to compare before (baseline) and after (CPAP and OA) therapy. The OA used in this study is DIORS® - Dispositivo Intra Oral Restaurador do Sono. It modifies the upper airway, changing both the jaw and tongue posture. Its constructive is grounded in Functional Jaw Orthopedics concepts. Variance analysis for repeated measurements are applied to compare the results with 5% significance level. The IAH 31.57 (32.00) is evaluated by the American Academy of Sleep Medicine criteria (AHI < 5); the snore, by snoring score 3.5 (0.65); EDS, by Epworth Sleepiness Scale (ESS) 10:43 (5.87); and the quality of sleep, by sleep efficiency (ES) 80.86 (11.41) and AI 27.18 (26.36); cardiovascular health, cardiac beat major (CB_{major}) 89.26 (27.60).

Results: The study provides evidence of improvement in snoring (p-value 0.0038). BMI variations may have important role in OSA and were evaluated before other parameters (p-value 0.0065). There is an increase in mean BMI 30.37 (4.67), suggesting not be reasonable to assume that improvements have been caused by the reduction in body mass, and so it is assessed three parameters associated with sleep quality. Despite the significant increase in BMI, ESS (p-value 0.047) and ES (p-value 0.040) and AI (p-value 0.042) showed significant improvements of patients' health. Noteworthy is the successful treatment for patients distribution according to the classification of AHI < 5, 10 patients for CPAP and 12 for the OA (p-value 0.23). A highly significant finding is observed in the OA CB_{major} 76.90 (13.50) compared to CPAP CB_{major} 108.00 (59.5) with p-value 00029.

Conclusions: Among patients with OSA, despite the increase in BMI, both the CPAP and OA therapy suggest improvement in patient's health, but due to preference for AO, this appeared

more efficiency and effectiveness. It is recommended further studies to evaluate these results with the OA used.

POSTER #017

Knowledge and Concern About OSA in Adherent and Non-Adherent OSA Patients

Firestone AR, Maerz R, Pennington V, St. John M, Roth J, Jenkins A, Skulski B

Columbia University

Introduction: Sleep-disordered breathing is associated with significant morbidity and mortality. A major problem with those who are diagnosed and begin treatment is a low rate of adherence to treatment. One approach to increasing adherence to treatment has been to educate patients about obstructive sleep apnea, it's causes, treatments and consequences if not treated. The aim of this research was to survey patients who had been given an oral appliance for obstructive sleep apnea for their perceived level of knowledge of, and concern about OSA.

Methods: The Ohio State University Institutional Review Board approved this study. All patients who had received an oral appliance between October 2008 and March 2015 in one university associated private practice were contacted by phone and asked to respond to a series of questions regarding their appliance.

Results: Of the 242 eligible patients, 80 responded to the phone call invitation. Fifty-eight reported that they were adherent with their oral appliance therapy and 22 reported that they were no longer using an oral appliance. The mean age, and initial BMI were 58.1 years, BMI 30, and 59.3 years and BMI 28.7 for the adherent and non-adherent groups respectively. Females were 36% in the adherent group and 45% in the non-adherent group. In the non-adherent group, 12 of the 22 reported that they were currently using CPAP. The mean knowledge on a scale of 0 (No knowledge) to 10 (Knowledgeable) was 7.7 in the adherent group and 8.1 in the non-adherent group. The mean concern on a scale of 0 (Unconcerned) to 10 (Concerned) about the consequences of untreated sleep apnea, was 8.4 for the adherent group and 7.1 for the non-adherent group. Within the 22 patients who were no longer wearing their oral appliances, 12 were using CPAP and 10 were not using any treatment. The scores for the CPAP and No-treatment patients were 8.1 and 8.3 for knowledge and 8.0 and 5.5 for concern, respectively. The two groups were similar in age and BMI. There was no large difference in their professed knowledge about OSA, but there was a larger difference in their reported concern about the consequences of untreated OSA. This disparity in concern about the consequences of untreated OSA was even greater when patients who were not treating their obstructive sleep apnea were compared with those who were undertaking some treatment. This could be a reason why the non-adherent group did not continue treatment, or it could be a justification for why they were non-adherent.

Conclusions: It does appear that one factor that could lead to increased adherence to oral appliance therapy for sleep apnea is patient education focused on the consequences of untreated OSA.