

SPECIAL ARTICLES

Multidisciplinary Alternatives to CPAP Program for CPAP-Intolerant Patients

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Continuous positive airway pressure (CPAP) intolerance remains a persistent problem for many obstructive sleep apnea patients. Clinicians and researchers continue to search for other effective treatment modalities given the well-documented sequelae associated with untreated obstructive sleep apnea.

A multidisciplinary “Alternatives to CPAP program” (ALT) can facilitate systematic evaluation of non-CPAP therapies appropriate for an individual patient. We review successful strategies and barriers encountered during implementation of an ALT at our institution. Creation of similar programs in private practice and academic settings can help medical, dental, and surgical sleep medicine specialists coordinate evaluation and treatment of CPAP-intolerant patients.

Keywords: alternative treatments, CPAP intolerance surgery, multidisciplinary, obstructive sleep apnea, oral appliance

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INTRODUCTION

Multidisciplinary treatment approaches are used for chronic disease management in adult and pediatric patients.^{1–3} Multidisciplinary care may provide benefits to patients with obstructive sleep apnea (OSA),⁴ a complex disease process with anatomic and neurologic etiologies. Although continuous positive airway pressure (CPAP) therapy remains the gold standard treatment for OSA, many CPAP-intolerant patients often discontinue therapy and thus go untreated.⁵ When patients explore non-CPAP treatments for OSA, communication between providers and patients can generate confusion because of the variety of non-CPAP treatment options currently available. Integrated care models with dentistry and sleep medicine have been previously described,⁶ as have examples of coordinated dental and surgical care for treatment of OSA.⁷ Optimal and personalized treatment of CPAP-intolerant patients requires the skills and knowledge of medical and dental professionals from a variety of specialties, including sleep medicine, dentistry, oral and maxillofacial surgery, and otolaryngology.

A multidisciplinary “Alternatives to CPAP program” (ALT) was started at our institution to address these potential issues and to improve the care of CPAP-intolerant patients. We discuss the operational planning of an ALT, descriptions of each provider’s role, and experiences from our ALT. We also review opportunities within an ALT to enhance interprofessional education.

WHY AN ALT WAS ESTABLISHED

The University of Michigan’s ALT was established to enhance patient-provider and provider-provider communication and to reduce fragmentation of care. The stated goals of this program are to (1) facilitate evaluation and treatment of patients who are

unable or unwilling to use CPAP, (2) improve communication between surgeons, dentists, and sleep medicine physicians, and (3) educate fellows and residents in sleep medicine, dentistry, oral and maxillofacial surgery, and otolaryngology.

LOGISTICAL CONSIDERATIONS WHEN STARTING AN ALT

A dedicated program coordinator is charged with (1) patient scheduling, (2) confirmation of insurance prior authorization when necessary, (3) requisition of outside records (including sleep studies and previous surgical notes), (4) appointment coordination, and (5) maintenance of an ALT database.

To optimize ALT efficiency and effectiveness, patients are scheduled for consultation in the “ALT screening clinic” with a sleep medicine specialist to determine whether an ALT visit is the appropriate next step. Those patients who are willing to troubleshoot difficulties with and continue using CPAP are not scheduled into the ALT.

Patients who are unable or unwilling to use CPAP further are then scheduled for an ALT visit. These patients must have polysomnographically confirmed OSA within the past 3 y, or more recently for patients with a significant interval change in weight or health status. Home sleep apnea test results are considered on a case-by-case basis; some patients are requested to have an attended polysomnogram before an ALT treatment recommendation is finalized. There is no body mass index (BMI) or OSA severity cutoff for a patient to be scheduled for ALT evaluation, but these factors are considered in the development of an ALT treatment plan.

Insurance prior authorization requirements are often region-specific and should be carefully addressed when starting and sustaining an ALT. Need for prior authorizations is clearly

Table 1—Role of each specialist in a multidisciplinary “Alternatives to CPAP program.”

Sleep Medicine	Dentistry	Oral and Maxillofacial Surgery	Otolaryngology
Focused history to identify barriers to CPAP use: <ul style="list-style-type: none"> • mask interfaces • pressure modalities and settings • occupation • travel • time without access to reliable power source 	Focused history to assess for: <ul style="list-style-type: none"> • periodontal disease • temporomandibular disorders • myofascial pain • medical comorbidities that would interfere with oral appliance use 	Oral evaluation: <ul style="list-style-type: none"> • tooth and gingival show in repose and full animated smile • angle classification of occlusion • extent of dental overbite and overjet • status of the dentition 	Focused history to assess for: <ul style="list-style-type: none"> • laryngopharyngeal and gastroesophageal reflux • nasal obstruction • chronic rhinitis • sinusitis • dysphagia
Determine factors that may influence OSA severity: <ul style="list-style-type: none"> • sleep stage • sleep position • medical comorbidities • medication use 	Examination to determine the extent of mandibular protrusion: <ul style="list-style-type: none"> • palpation and loading of the temporomandibular joints • mouth opening • maximal mandibular protrusion • lateral excursive movements 	Facial examination: <ul style="list-style-type: none"> • facial profile • frontal facial symmetry • chin-throat length • thyromental distance • hyoid position • facial soft-tissue laxity and thickness 	Examination: <ul style="list-style-type: none"> • nasal septal deviation • turbinate hypertrophy • tonsil size • palatal length • presence of redundant soft palatal tissue • tongue size
Establish longitudinal care for OSA management	Evaluation of dentition: <ul style="list-style-type: none"> • static and dynamic occlusion • periodontal support • adjacent soft tissue 	Cephalometric imaging and low-radiation cone beam computed tomography: <ul style="list-style-type: none"> • determine upper airway caliber and sites of maximal obstruction 	Flexible fiberoptic laryngoscopy: <ul style="list-style-type: none"> • examine the hypopharynx and supraglottic larynx Drug-induced sleep endoscopy: <ul style="list-style-type: none"> • evaluate for concentric collapse of the retropalatal airway

CPAP = continuous positive airway pressure, OSA = obstructive sleep apnea.

discussed with patients before an ALT visit is scheduled, and the ALT program coordinator ensures that all needed prior authorizations are obtained before ALT treatment is implemented.

ALT team members must agree on available days and clinic space. Fiberoptic endoscopes, cephalometric radiography, cone-beam computed tomography, and related support staff must also be available to maintain efficient patient throughput in the ALT.

ROLE OF EACH PROVIDER IN AN ALT

Table 1 summarizes the role of each provider in a multidisciplinary “Alternatives to CPAP program.” Every ALT patient is seen by each ALT provider during the appointment.

Sleep Medicine

The sleep medicine specialist meets with each patient to discuss sleep study results and review the patient’s barriers to CPAP, then presents this information at the multidisciplinary ALT conference so that all ALT providers have a shared understanding of the patient’s history. Patients with morbid obesity (BMI > 40 kg/m²) and associated co-morbidities may be referred for formal evaluation by the bariatric surgery program. Others with a BMI > 30 may be referred to the medical weight loss program as a component of their OSA management. Referral to medical weight loss programs may be considered on a case-by-case basis. Positional therapy is discussed for appropriate patients. Last, the sleep medicine specialist reinforces to ALT patients the importance of effective, long-term OSA treatment.

Dentistry

A dental sleep medicine specialist determines an ALT patient’s candidacy for oral appliance therapy. Patients with mild to moderate OSA are most likely to benefit.⁸ Relative contraindications to treatment include seizure disorders, spastic cerebral palsy, rheumatoid arthritis involving the temporomandibular joints, Sjögren syndrome with xerostomia, certain psychiatric disorders, or fibromyalgia with associated myofascial pain of the head and neck. Location of any head and neck pain, type of diet tolerated, presence of limited mouth opening, history of lockjaw, difficulty with chewing or talking, history of facial trauma, and history of bruxism or periodontal disease may influence a patient’s candidacy for oral appliance therapy.⁹ ALT patients are evaluated for extent of mouth opening, maximal mandibular protrusion, and lateral excursive movements to determine the feasibility of obtaining impressions and the extent of mandibular protrusion.

Oral and Maxillofacial Surgery

Unique components of the maxillofacial examination include the facial profile, projection of the mandible and maxilla, frontal facial symmetry, chin-throat length, thyromental distance, hyoid position, and facial soft-tissue laxity and thickness.¹⁰ Patients in the ALT undergo a two- and three-dimensional radiographic survey of the upper airway that helps identify sites of maximal obstruction. A panoramic radiograph screens for dental, temporomandibular joint, or maxillofacial pathology that may require treatment prior to surgical intervention. A lateral cephalogram is obtained in natural head position to assess skeletal relations of the maxilla and mandible, hyoid position,

airway length, soft palate length, anterior skull base angle, and the posterior airway space.¹¹ A low-radiation cone beam computed tomography scan provides three-dimensional data to determine the upper airway volume from the hard palatal plane (superior boundary) to the base of the epiglottis (inferior boundary), as well as the minimal cross-sectional area and its location.

Oral and maxillofacial surgeons may offer maxillomandibular advancement surgery and/or genioglossus advancement to ALT patients. Although maxillomandibular advancement is typically reserved for select patients with moderate to severe OSA,¹² genioglossus advancement alone may have utility in select patients with mild or moderate OSA. These procedures expand the facial skeleton anteriorly and displace all associated soft-tissue and muscle attachments to achieve multilevel (via maxillomandibular advancement) or retroglossal (via genioglossus advancement) expansion of the upper airway.¹³ Negative postoperative alterations in facial appearance are typically minimized by selecting patients with a retrognathic maxillomandibular complex and undersupported or lax facial soft tissues.

Otolaryngology

Laryngopharyngeal and gastroesophageal reflux symptoms,¹⁴ nasal obstruction, and chronic rhinitis and sinusitis symptoms are explored. Nasal septal deviation, turbinate hypertrophy, tonsil size, palatal length, presence of redundant palatal tissue and macroglossia (a tongue that resides above the occlusal plane), or relative macroglossia (a size disproportion between the width of the tongue versus the mandibular arch) are identified. Tongue position is rated with the Friedman classification (tongue in a natural, neutral position within the mouth) and the modified Mallampati classification (tongue at maximal protrusion). The tongue position with the Friedman classification has been correlated with surgical outcomes¹⁵ and the tongue position with the Mallampati classification has been associated with likelihood of difficult endotracheal intubation.¹⁶

All patients seen in the ALT undergo flexible fiberoptic laryngoscopy, which evaluates the hypopharynx and supraglottic larynx for significant narrowing of the posterior airway space. Currently, only those ALT patients who are possible candidates for hypoglossal nerve stimulation undergo drug-induced sleep endoscopy; these patients may consider hypoglossal nerve stimulation if the absence of concentric retropalatal collapse is confirmed during drug-induced sleep endoscopy¹⁷ and the other United States Food and Drug Administration-approved criteria are met, including apnea-hypopnea index of 20–65 events/h and BMI < 32 kg/m².

The otolaryngologic surgeries offered to ALT patients can be adjunctive, salvage, or curative. Adjunctive nasal surgery may facilitate improved postoperative CPAP adherence due to lower CPAP requirements (average of 2–3 cm H₂O) or improved tolerance of nasal-type masks without necessity for a chin strap.¹⁸ Salvage surgeries, such as isolated palatal surgeries and multilevel procedures combining palatal and hypopharyngeal surgeries,^{19,20} have been shown to reduce OSA severity and improve quality-of-life measures. Curative otolaryngologic surgery has historically been limited

to tracheostomy, which may be indicated for patients with severe OSA and associated comorbidities.²¹ Hypoglossal nerve stimulation may effectively treat some patients with moderate to severe OSA.²²

PATIENT FLOW THROUGH AN ALT

Figure 1 depicts the ALT process flow. During the multidisciplinary case conference at the conclusion of each clinic, the sleep medicine specialist guides the group discussion in a standardized format. An individual treatment plan is formulated, taking into account (1) the patient's physical examination findings including BMI and identified site(s) of obstruction, (2) polysomnography findings with attention to the severity and positional/sleep stage dependence, (3) general medical status, and importantly, (4) patient preference.

A summary letter with treatment options prioritized as ALT team consensus recommendations is sent to the patient, primary care provider, and referring provider. The sleep medicine specialist calls the patient to review the proposed treatment options. After the patient agrees to a treatment plan, further testing (if needed) and appointments are scheduled through the appropriate service (e.g., operating room scheduling, dental moldings, etc.). Sleep clinic follow-up is also arranged to ensure posttreatment polysomnography and longitudinal management of each patient's OSA.

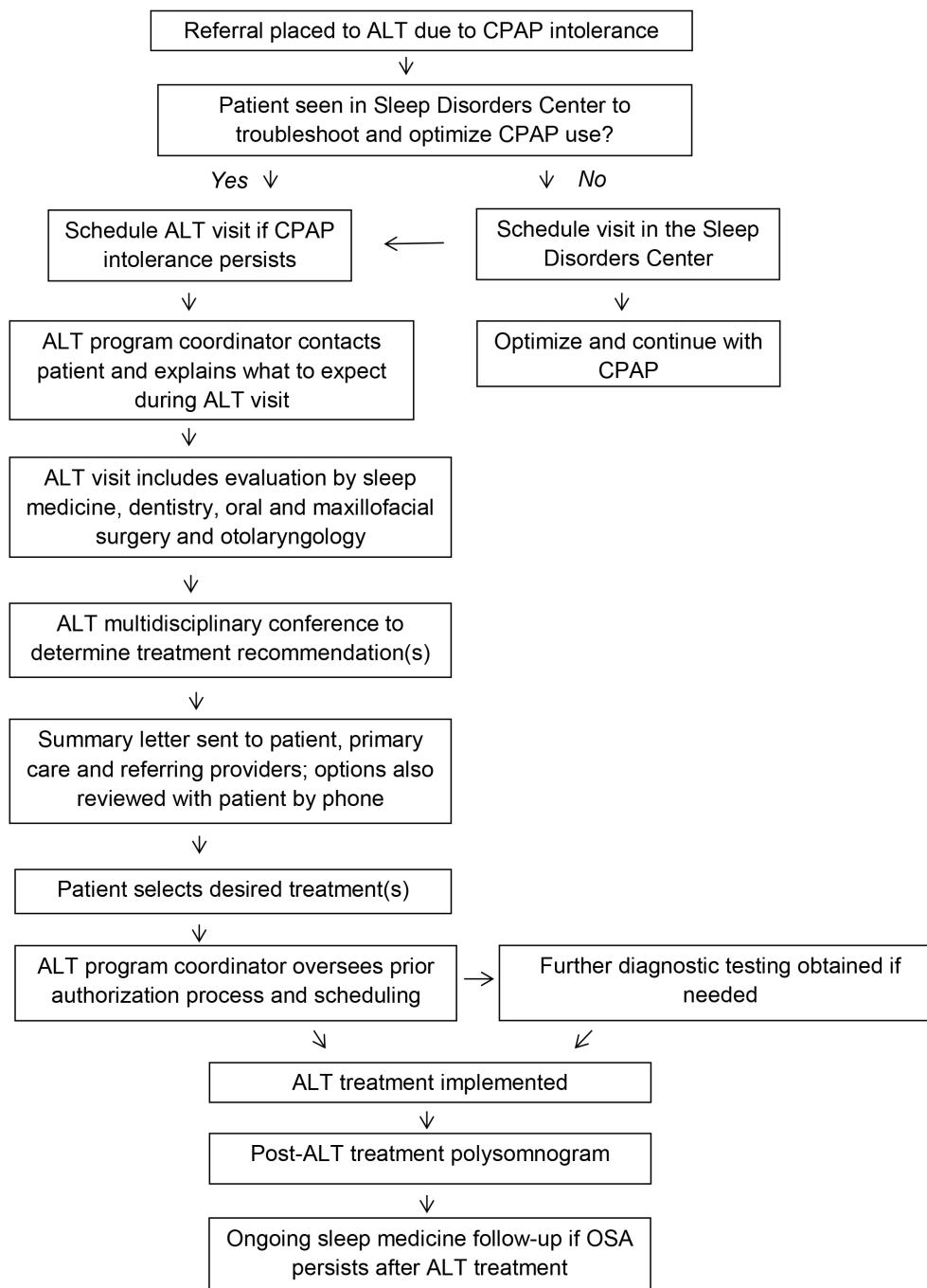
DATA FROM OUR ALT

The University of Michigan ALT database was reviewed from January 1, 2006 through December 1, 2015. Potential treatment options offered to ALT patients during this time period are summarized in **Table 2**. This work received an exemption from the University of Michigan institutional review board, identification number HUM00120049.

The data presented include 7 y (2006–2012) during which all patients referred to the ALT were scheduled for an ALT visit, along with 3 y (2013–2015) in which patients were seen in an ALT screening clinic with a sleep medicine specialist to determine if evaluation by all ALT providers was appropriate. Implementation of the ALT screening clinic nearly halved the total number of patients seen in the ALT. In turn, the percentage of patients advised to try a new mask interface or continue with current therapy decreased and the percentage of patients offered certain non-CPAP treatment options increased. It has been our experience that an effective ALT screening clinic identifies patients who should continue efforts with CPAP versus those patients unwilling or unable to use CPAP who should receive a comprehensive ALT evaluation to consider non-CPAP treatments for OSA. The overall utility of the ALT experience is subsequently enhanced for both patients and providers.

Some of the variability in non-CPAP treatments offered to ALT patients may reflect different practice styles of ALT providers. Multiple providers from each specialty have participated in our ALT since its establishment. Differences in

Figure 1—Alternatives to CPAP program flow algorithm.



ALT = Alternatives to CPAP program, CPAP = continuous positive airway pressure, OSA = obstructive sleep apnea.

individual preferences, evolution of surgical techniques, and incorporation of new technologies may also add to variations in the ALT treatment options offered to patients over time.

PREINTERVENTION AND POSTINTERVENTION POLYSOMNOGRAPHY

As previously noted, ALT patients should have a baseline polysomnogram within the past 3 y or more recently if there has

been an interval change in weight or health status. The ALT program coordinator obtains insurance authorization before postintervention polysomnography is scheduled. After insurance authorization is obtained, patients who are candidates for mandibular advancement devices should undergo a titration study with various degrees of mandibular protrusion to determine the therapeutic potential of oral appliance therapy.²³ Following surgical intervention, a postoperative polysomnogram may be obtained at 3 to 6 mo to allow for resolution of pharyngeal edema and stabilization of the airway as

Table 2—Treatment options offered to patients seen in the University of Michigan Alternatives to CPAP program from 2006–2015.

Year	Number of Patients	Continue Current Treatment	Change Mask Interface	Weight Management ± Bariatric Surgery Referral	Oral Appliance ± RCMP	Nasal Surgery	UPPP	TRACH	MMA	GAHS	Tongue Base Surgery	DISE ± HGNS
2015	81	28 (35)	8 (10)	31 (38)	41 (51)	32 (40)	33 (41)	8 (10)	23 (28)	33 (41)	15 (19)	14 (18)
2014	72	26 (36)	7 (10)	18 (25)	35 (49)	43 (60)	37 (51)	7 (10)	29 (40)	41 (57)	18 (25)	–
2013*	84	16 (19)	5 (6)	15 (18)	36 (43)	51 (61)	33 (39)	2 (2)	30 (36)	35 (42)	18 (21)	–
2012	144	57 (40)	57 (40)	45 (31)	65 (45)	60 (42)	69 (48)	9 (6)	42 (29)	47 (33)	15 (10)	–
2011	141	52 (37)	51 (36)	39 (28)	44 (31)	43 (30)	63 (45)	8 (6)	49 (35)	0 (0)	0 (0)	–
2010	134	66 (49)	45 (34)	65 (49)	58 (43)	48 (36)	84 (63)	11 (8)	57 (43)	6 (4)	12 (9)	–
2009	141	69 (49)	52 (37)	59 (42)	55 (39)	16 (11)	71 (50)	9 (6)	66 (47)	–	–	–
2008	148	76 (51)	52 (35)	53 (36)	55 (37)	10 (7)	59 (40)	10 (7)	59 (40)	–	–	–
2007	164	70 (43)	37 (23)	67 (41)	67 (41)	7 (4)	94 (57)	20 (12)	69 (42)	–	–	–
2006	163	88 (54)	50 (31)	96 (59)	70 (43)	13 (8)	74 (45)	7 (43)	65 (40)	–	–	–

Data listed in each treatment column are presented as number of patients (percent of patients). Total percentages in a given year may exceed 100 because patients are often presented with multiple treatment options to consider. * = implementation of Alternatives to CPAP program screening clinic with a sleep medicine specialist. DISE = drug-induced sleep endoscopy, GAHS = genioglossus advancement with hyoid suspension, HGNS = hypoglossal nerve stimulation, MMA = maxillomandibular advancement, RCMP = testing with a remotely controlled mandibular positioner, TRACH = tracheostomy, UPPP = uvulopalatopharyngoplasty.

lengthened suprahyoid and parapharyngeal muscles assume their new resting lengths after skeletal surgery.²⁴

EDUCATIONAL OPPORTUNITIES IN AN ALT

Interprofessional education is an essential component of health professional education and has been endorsed by the Institute of Medicine as a means to improve quality of care.²⁵ The ALT allows attending physicians from different specialties to learn from and work with each other, and also provides the same benefit to trainees at various points in their education. Students, residents, and fellows from multiple departments spend time in the ALT, where they have the opportunity for direct interaction with specialists outside of their own field. Learners are expected to present portions of the multidisciplinary conference to improve their medical knowledge and patient care capabilities, and to sharpen their peer-teaching skills.

Trainees in a sleep medicine fellowship program accredited by the Accreditation Council for Graduate Medical Education are required to have training in “practice management of sleep medicine.”²⁶ Participation in the ALT provides learners with unique exposure and real-life examples of how clinical factors, patient preference, cost, and effective resource utilization are all important in formulation of each patient’s treatment plan. Learners also gain understanding of logistical considerations (e.g. personnel, equipment, prior authorizations, and billing specifications) required to establish an ALT should they choose to do so later in their respective careers.

CONCLUSIONS

The ALT program described enables direct communication between medical, dental, and surgical specialists who treat CPAP-intolerant OSA patients and provides these patients

with an organized, resourceful consideration of non-CPAP treatment modalities. ALT evaluation is but one component of longitudinal OSA management. Patients need continued follow-up if OSA persists after an ALT treatment.

Ongoing communication with third-party payers is needed to improve insurance coverage for non-CPAP treatment modalities; only then will patients be able to truly consider all medically reasonable treatments available to each individual.

The experience gained from an ALT can be applied to develop other multidisciplinary programs to enhance the care of patients with sleep disorders. Optimized process efficiency will help an ALT serve a greater number of patients. As more ALT are established across geographic regions, in private practice and academic settings, experiences can be shared to further expand the potential of these programs. Multidisciplinary collaboration within a program and across institutions will facilitate development of best practices, creation of appropriate quality measures and educational competencies, and tracking of patient outcomes.

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