EVIDENCE-BASED RESEARCH REFERENCE GUIDE

DENTISTRY, CRANIOFACIAL GROWTH, MYOFUNCTIONAL THERAPY & SLEEP-DISORDERED BREATHING

ARTICLE FOR REFERENCE FOR SLEEP DISORDERED BREATHING AND DENTAL PERSPECTIVE

Vaishnavi P. et al. (2026) — "Association between mouth breathing and pediatric obstructive sleep apnea: a systematic review." European Archives of Oto-Rhino-Laryngology

Zhao Z. et al. (2021) — "Effects of mouth breathing on facial skeletal development in children: a systematic review and meta-analysis."

Craniofacial structure ↔ Pediatric sleep-disordered breathing

Katyal et al., 2013 – Systematic review & meta-analysis

Craniofacial and upper airway morphology in pediatric sleep-disordered breathing.

OSA ↔ Dental and craniofacial characteristics

Liu et al., 2023 – Systematic review

The dental and craniofacial characteristics among children with obstructive sleep apnoea. PMID 36763565. The review specifically evaluated associations between pediatric OSA and dental/craniofacial characteristics.

SDB ↔ Malocclusion

Hansen et al., 2022 – Systematic review

Sleep-disordered breathing and malocclusion in children and adolescents. PMID 34779522. It evaluated whether SDB is associated with malocclusion in children aged 6–15 years.

Narrow palate, long-face pattern, crowding + mouth breathing ↔ SDB symptoms

Huynh et al., 2011 found pediatric SDB symptoms were associated with adenotonsillar hypertrophy and characteristics including a long/narrow facial pattern, narrow palate, dental crowding, allergies and habitual mouth breathing

Rapid maxillary expansion and pediatric OSA — evidence exists, but be careful

Earlier systematic reviews/meta-analyses reported reductions in AHI after RME in selected children. Camacho et al. 2017,

ADULT SLEEP APNEA — STRONGEST DENTAL TREATMENT CONNECTION: MAD MANDIBULAR ADVANCEMENT DEVICES ARE SUPPORTED BY CONSIDERABLY STRONGER EVIDENCE IN ADULT OSA. A 2024 SYSTEMATIC REVIEW/META-ANALYSIS FOUND MAD THERAPY IMPROVED AHI IN OSA PATIENTS, WITH TREATMENT RESPONSE INFLUENCED PARTLY BY SLEEP POSITION.

Li J, et al. (2022). Effects of mouth breathing on maxillofacial and airway development in children and adolescents.

Katyal V, et al. (2013). Craniofacial and upper airway morphology in pediatric sleep-disordered breathing: systematic review and meta-analysis. AJODO. **PMID: 23273357**.

Moss ML, Salentijn L. The primary role of functional matrices in facial growth. Am J Orthod. 1969;55(6):566–577. **PMID: 5253955**.

Lieberman DE, Krovitz GE, Yates FW, Devlin M, St Claire M.

“Effects of food processing on masticatory strain and craniofacial growth in a retrognathic face.”Journal of Human Evolution. 2004;46(6):655–677.

Wheatley JR, Amis TC, Engel LA. “Nasal and oral airway pressure-flow relationships.” J Appl Physiol. 1991;71(6):2317-2324. **PMID: 1778929**. DOI: 10.1152/jappl.1991.71.6.2317.

Laborde S, et al. “Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis.” Neurosci Biobehav Rev. 2022;138:104711. **PMID: 35623448**. DOI: 10.1016/j.neubiorev.2022.104711

Lundberg JO, et al. “Primarily nasal origin of exhaled nitric oxide and absence in Kartagener's syndrome.” Eur Respir J. 1994. **PMID: 7957837**.

Törnberg DCF, et al. “Nasal and oral contribution to inhaled and exhaled nitric oxide.” Eur Respir J. 2002. **PMID: 12030725**. The study supports the concept that nasal NO is auto-inhaled into the lower respiratory tract and can influence pulmonary physiology.

Kulur AB, Haleagrahara N, Adhikary P, Jeganathan PS. “Effect of diaphragmatic breathing on heart rate variability in ischemic heart disease with diabetes.” Arq Bras Cardiol. 2009. **PMID: 19629309**.Regular diaphragmatic breathing significantly improved HRV in that patient population.

Corrêa ECR, Bérzin F. “Mouth Breathing Syndrome: cervical muscles recruitment during nasal inspiration before and after respiratory and postural exercises.” Int J Pediatr Otorhinolaryngol. 2008. **PMID: 18603307**. It provides evidence that children with mouth-breathing syndrome can demonstrate altered recruitment of cervical/accessory respiratory musculature.

Ehsan Z, Ishman SL, Kimball TR, et al.

Management of Persistent, Post-adenotonsillectomy Obstructive Sleep Apnea in Children: An Official American Thoracic Society Clinical Practice Guideline.

American Journal of Respiratory and Critical Care Medicine. 2024;209(3):248–261.

PMID: 37890009.

Lieberman DE, et al. Effects of food processing on masticatory strain and craniofacial growth in a retrognathic face. Journal of Human Evolution. 2004;46(6):655–677. PMID: 15183669.

Shull LC, et al. Epigenetic Regulation of Craniofacial Development and Disease. 2024. PMID: 37964651.

Sandra Kahn, Paul Ehrlich, Marcus Feldman, Robert Sapolsky, Simon WongThe Jaw Epidemic: Recognition, Origins, Cures, and Prevention.Bioscience 2020 july 22 PMID: 32973408

Yoon A, Gozal D, Kushida C, Pelayo R, Liu S, Faldu J, Hong C.

“A roadmap of craniofacial growth modification for children with sleep-disordered breathing: a multidisciplinary proposal.”Sleep. 2023;46(8):zsad095.

PMID: 37014012 | PMCID: PMC10424160 | DOI: 10.1093/sleep/zsad095

Cuccia AM et al. — “Oral breathing and head posture.” Angle Orthodontist, 2008.

da Silveira W et al. — "Postural alterations and pulmonary function of mouth-breathing children." Brazilian Journal of Otorhinolaryngology, 2010.

da Silveira W et al. — "Postural alterations and pulmonary function of mouth-breathing children." Brazilian Journal of Otorhinolaryngology, 2010.

zhao Z et al. — "Effects of mouth breathing on facial skeletal development in children: a systematic review and meta-analysis." 2021.

EXPANSION AND SLEEP DISORDERED BRETHING EVIDENCE BASED RESEARCH:

Camacho M, et al., 2017 — RME + Pediatric OSA | Systematic Review & Meta-analysis

Rapid maxillary expansion for pediatric obstructive sleep apnea: A systematic review and meta-analysis. This is one of the most frequently cited RME–sleep papers and reported improvement in polysomnographic outcomes after RME in selected children. **PMID: 27796040**.

Bucci R, et al., 2023 — Orthodontic treatment + Pediatric OSA | Systematic Review & Meta-analysis

Effect of orthopedic and functional orthodontic treatment in children with obstructive sleep apnea: A systematic review and meta-analysis. Particularly useful because it evaluates orthopedic maxillary expansion and functional mandibular approaches rather than discussing only one appliance. **PMID: 36525781**.

Aksilp C, et al., 2025 — RME vs Adenotonsillectomy | Randomized Controlled Trial

A randomized controlled trial comparing treatment efficacy between rapid maxillary expansion and adenotonsillectomy in pediatric obstructive sleep apnea. Both interventions improved sleep-related respiratory parameters; RME showed comparable improvement in several PSG variables, while adenotonsillectomy produced greater improvement in some clinical/QOL outcomes. **PMID: 40739069**.

Villa MP, et al., 2007 — RME + Pediatric OSAS | Prospective clinical study

Rapid maxillary expansion in children with obstructive sleep apnea syndrome. One of the important early clinical studies showing improvement in children with OSA and maxillary constriction treated with RME. **PMID: 17239661**.

Villa MP, et al., 2011 — RME + 24-month follow-up

Efficacy of rapid maxillary expansion in children with obstructive sleep apnea syndrome: 36 months of follow-up. Particularly useful for your presentation because treatment effects were evaluated beyond the immediate expansion period. **PMID: 21437777**.

Yoon A, et al., 2022 — Audrey Yoon | RPE + Adenoid/Tonsil dimensions

Impact of rapid palatal expansion on the size of adenoids and tonsils in children. The study found significant changes in adenotonsillar dimensions after RPE and is useful for explaining why orthopedic modification of the nasal/maxillary complex may interact with the surrounding airway. **PMID: 35390750**.

Yoon A, et al., 2020 — Audrey Yoon | DOME + Adult OSA

Distraction Osteogenesis Maxillary Expansion (DOME) for adult obstructive sleep apnea patients with narrow maxilla and nasal floor. In this selected adult phenotype, DOME was associated with reduced OSA severity, improved nasal obstruction and daytime sleepiness, and increased REM sleep percentage. **PMID: 31606311**.

Important: this is adult surgical expansion, so don't use it as direct evidence for conventional pediatric RME.

Yoon A, Gozal D, Kushida C, Pelayo R, Liu S, et al., 2023 — Audrey Yoon | Craniofacial growth roadmap

A roadmap of craniofacial growth modification for children with sleep-disordered breathing: a multidisciplinary proposal. Sleep. 2023;46(8):zsad095. **PMID: 37014012**. This is excellent for your overall lecture because it proposes age-related craniofacial interventions from childhood into adulthood and places orthodontic therapy within multidisciplinary SDB management.

Note: it is a clinical roadmap/proposal, not an RCT.

Guimarães KC, et al., 2009 — Myofunctional therapy | Randomized sham-controlled trial

Effects of oropharyngeal exercises on patients with moderate obstructive sleep apnea syndrome. Thirty-one adults were randomized to sham treatment or approximately 30 minutes/day of tongue, soft-palate and pharyngeal exercises for three months. AHI decreased in the exercise group from approximately 22.4 to 13.7 events/hour, along with improvement in snoring and sleepiness. **PMID: 19234106**.

Camacho M, et al., 2015 — Myofunctional therapy | Systematic Review & Meta-analysis

Myofunctional Therapy to Treat Obstructive Sleep Apnea: A Systematic Review and Meta-analysis. This foundational meta-analysis reported substantial reductions in AHI, with the authors concluding that MT could be considered an adjunctive treatment for OSA. **PMID: 25348130**.

Bandyopadhyay A, et al., 2020 — Pediatric OMT | Systematic Review & Meta-analysis

Effect of myofunctional therapy on children with obstructive sleep apnea: a meta-analysis. Particularly important for your pediatric presentation. The pooled evidence suggested approximately a 43% reduction in AHI and improvement in oxygen saturation, while noting heterogeneity among exercise protocols. **PMID: 32861058**.

Rueda JR, et al., 2020 — Cochrane Review | Myofunctional therapy

Myofunctional therapy (oropharyngeal exercises) for obstructive sleep apnoea. This is essential for keeping your lecture balanced. Cochrane found potential benefit for some outcomes but graded much of the evidence from moderate to very low certainty and emphasized the need for better blinded trials. **PMID: 33141943**.

Guilleminault C, et al., 2013 — Pediatric SDB + Myofunctional re-education

Critical role of myofascial reeducation in pediatric sleep-disordered breathing. This is highly relevant to your concept of “expand the structure + restore the function.” The study evaluated children who underwent adenotonsillectomy and orthodontic treatment and examined the importance of myofunctional re-education in longer-term SDB outcomes. **PMID: 23522724**.

Preedeewong C, et al., 2024 — DOUBLE-BLIND randomized controlled study

Impact of frenectomy on oral exercise in patients with ankyloglossia and obstructive sleep apnea: double-blind randomized controlled clinical trial. This is the blinded study you asked for. It compared oral exercise alone with oral exercise plus frenectomy in adults with ankyloglossia and mild–moderate OSA. **PMID: 39365358**.

Caution: small adult study, and it specifically addresses ankyloglossia/frenectomy + exercises; don't present it as definitive evidence that frenectomy treats pediatric OSA.

Xu Y, et al., 2025 — Myofunctional therapy | Network Meta-analysis of RCTs

Efficacy of myofunctional therapy for obstructive sleep apnea: a systematic review and network meta-analysis of randomized controlled trials. This is one of the more recent higher-level analyses examining MT across randomized trials in adult and pediatric OSA. **PMID: 40716836**.

ADULT SLEEP APNEA AND EVIDENCE BASED RESEARCH ARTICLE

Ramar K, et al. 2015 — AASM/AADSM Clinical Practice Guideline

Clinical Practice Guideline for the Treatment of Obstructive Sleep Apnea and Snoring with Oral Appliance Therapy.

J Clin Sleep Med. 2015;11(7):773–827. **PMID: 26094920**.

Recommends oral appliances for adults with OSA who are intolerant of CPAP or prefer alternate therapy, and specifically supports custom, titratable appliances provided by qualified dentists.

Sharples LD, et al. 2016 — Meta-analysis of RCTs

Meta-analysis of randomised controlled trials of oral mandibular advancement devices and CPAP for obstructive sleep apnoea-hypopnoeaMID: 26163056.

Both CPAP and MADs are clinically effective; CPAP generally reduces AHI more, while MADs remain an effective alternative, particularly in appropriate patients.

Liao J, et al. 2024 — Meta-analysis

Efficacy of Oral Appliance for Mild, Moderate, and Severe Obstructive Sleep Apnea: A Meta-analysis.

PMID: 38363016.

Included 42 studies and 2,265 patients and found clinically important improvement in OSA parameters with oral appliances, especially MADs.

Okuno K, et al. 2014 — Systematic Review & Meta-analysis of RCTs

The effect of oral appliances that advanced the mandible forward and limited mouth opening in patients with obstructive sleep apnea.

J Oral Rehabil. 2014;41:542–554. **PMID: 24650215**.

Oral appliances significantly reduced AHI and arousal index versus control; CPAP produced a larger reduction in AHI.

Bratton DJ, et al. 2015 — Network Meta-analysis

CPAP vs Mandibular Advancement Devices and Blood Pressure in Patients With Obstructive Sleep Apnea.

JAMA. **PMID: 26624827**.

Both CPAP and MADs were associated with reductions in blood pressure; the analysis did not find a significant difference between them for BP outcomes.

Neelapu BC, et al. 2017 — Craniofacial Meta-analysis

Craniofacial and upper airway morphology in adult obstructive sleep apnea patients: a systematic review and meta-analysis.

Sleep Med Rev. **PMID: 27039222**.

Strong paper for explaining why dentistry matters. Adult OSA was associated with craniofacial differences including mandibular position/length, maxillary dimensions, soft palate/tongue characteristics and reduced pharyngeal airway dimensions.

Aarab G, et al. 2011 — Randomized Placebo-Controlled Trial

Oral appliance therapy versus nasal continuous positive airway pressure in obstructive sleep apnea.

Respiration. **PMID: 20962502**.

In objectively titrated mild–moderate OSA, both MAD and CPAP significantly improved AHI compared with placebo; this study found no clinically relevant difference between MAD and CPAP when both were objectively titrated.

Gotsopoulos H, et al. 2002 — Randomized Controlled Trial

Oral appliance therapy improves symptoms in obstructive sleep apnea.

Am J Respir Crit Care Med. 2002;166:743–748. **PMID: 12204875**.

A mandibular advancement splint significantly improved daytime sleepiness and several OSA symptoms compared with an inactive oral appliance.

Petri N, et al. 2008 — Randomized Placebo-Controlled Trial

Mandibular advancement appliance for obstructive sleep apnoea.

J Sleep Res. 2008;17:221–229. **PMID: 18482111**.

Mandibular advancement significantly reduced AHI and sleepiness versus non-advancement appliance/no treatment, confirming that mandibular protrusion itself is therapeutic.

Yu M, et al. 2023 — Long-term MAD Meta-analysis

Long-term efficacy of mandibular advancement devices in adult obstructive sleep apnea.

PMID: 38015938.

Long-term MAD therapy significantly improved subjective sleepiness and objective sleep-related breathing outcomes, supporting durability of treatment in appropriate patients.

Chen H, et al. 2020 — Responder Phenotype Meta-analysis

Phenotypes of responders to mandibular advancement device therapy in obstructive sleep apnea patients: a systematic review and meta-analysis.

PMID: 31785583.

Very useful for your lecture because it shows that not every OSA patient responds equally; patient phenotype and anatomy influence MAD success.

Tallamraju H, et al. 2021 — Adherence Meta-analysis

Factors influencing adherence to oral appliance therapy in adults with obstructive sleep apnea.

J Clin Sleep Med. **PMID: 33660611**.

Custom-made appliances showed better adherence than ready-made appliances; side effects were an important reason for discontinuation, particularly early in treatment.

Yu M, et al. 2024 — Long-term Dental/Skeletal Side Effects Meta-analysis

Dental and skeletal changes of long-term mandibular advancement device therapy for obstructive sleep apnea.

PMID: 39174171.

Important for the dentist's role in long-term follow-up, because prolonged MAD use can produce measurable occlusal and dentoskeletal changes.

de Oliveira Machado CA, et al. 2024 — OSA & TMD Meta-analysis

Association between obstructive sleep apnea and temporomandibular disorders in adults: systematic review and meta-analysis.

PMID: 39007230.

Useful for connecting sleep apnea, TMD and orofacial pain and supporting careful TMJ assessment in dental sleep patients.

Alessandri-Bonetti A, et al. 2019 — MAD & TMD Systematic Review

Effects of mandibular advancement device for obstructive sleep apnea on temporomandibular disorders.

PMID: 31605905.

Examines whether MAD treatment causes or aggravates TMD signs and symptoms and reinforces the importance of pre-treatment TMJ examination and ongoing monitoring

BOOKS FOR REFERENCE OF SLEEP AND DENTAL CONNECTION

The Evolution of the Human Head: Daniel E. Lieberman.

Belknap Press of Harvard University Press, 2011.

Jaws: The Story of a Hidden Epidemic

Authors: Sandra Kahn, DDS, MSD & Paul R. Ehrlich, PhD Foreword: Robert Sapolsky Publisher: Stanford University Press Published: 2018

Sleep Disorders in Pediatric Dentistry — E. Liem

Springer. This is probably the best starting textbook for you because it is specifically written for pediatric dentists and covers recognition of sleep disorders, clinical signs, diagnosis/referral and dental treatment considerations.

ORthodontics in Obstructive Sleep Apnea Patients — Su-Jung Kim et al.

Springer. Excellent for the orthodontic/craniofacial side of OSA: diagnosis, treatment planning, maxillary expansion, mandibular approaches and orthodontists' role in multidisciplinary OSA care.

Myofunctional Therapy in Snoring and Sleep Apnea: Oropharyngeal Exercises and Sleep Disordered Breathing — Carlos O'Connor Reina, ed. (2026)

This is particularly relevant to your current talk. It covers the scientific basis of OMT, functional assessment, breathing retraining, tongue function, pediatric OSA, patient selection, limitations and combining OMT with established OSA treatments.

Snoring and Obstructive Sleep Apnea in Children — Amal Isaiah et al.

Elsevier. Very useful for your medical-doctor audience because it covers pediatric OSA broadly: genetics, growth and development, airway evaluation, PSG, DISE, adenotonsillectomy, maxillofacial procedures and orofacial myofunctional therapy.

The Clinician's Handbook for Dental Sleep Medicine

Quintessence. A practical dental reference describing the dentist's role in sleep-related breathing disorders and implementation of dental sleep medicine into practice.

The Evolution of the Human Head — Daniel E. Lieberman

For your earlier slides on evolution, diet, chewing, mechanical loading and craniofacial development, this is the foundational background book. I would use it to explain why function and environmental demands matter, rather than as direct evidence that expansion treats OSA.

BUNNY TEETH ADVANCED DENTISTRY

How We Help Children Breathe, Sleep and Grow Better

Our airway-focused paediatric approach combines screening, coordinated medical referral, myofunctional therapy and carefully selected palatal expansion.

How our treatments support function and growth

The Bunny Teeth functional airway pathway

Simple home practice - only when the nose is comfortably open

Selected references: AAO-HNS Clinical Indicators: Adenoidectomy; AAO-HNSF Tonsillectomy in Children guideline (2019); American Academy of Pediatrics childhood OSA guideline; American Thoracic Society persistent post-adenotonsillectomy OSA guideline (2024); systematic reviews of paediatric orofacial myofunctional therapy.

BUNNY TEETH CLINICAL PATHWAYS & PROTOCOLS

The 5-Step Functional Airway Pathway

1. SCREEN	2. ASSESS	3. COORDINATE	4. MYO THERAPY	5. GUIDE GROWTH
Snoring, mouth breathing, sleep quality, lip seal, tongue posture and daytime symptoms.	Palate width, crossbite, crowding, jaw position, oral ties, chewing and swallowing.	ENT or sleep referral for adenoids, tonsils, allergy, nasal blockage or suspected OSA.	Retrain nasal breathing, lip seal, tongue-to-palate posture, chewing and mature swallow.	Palatal expansion when a constricted upper jaw or crossbite is clinically confirmed.

Key Treatment Modalities

MYOFUNCTIONAL THERAPY	PALATAL EXPANSION
• Builds a comfortable nasal-breathing pattern after the nose is medically clear. • Improves relaxed lip seal without excessive chin-muscle effort. • Guides the tongue to rest against the palate and supports a mature swallow. • Retrains chewing, swallowing and oral habits that may continue after surgery. • Supports stability after orthodontic or ENT treatment through supervised home practice.	• Widens a clinically narrow upper jaw and corrects selected posterior crossbites. • Creates space for the tongue and developing permanent teeth. • May improve nasal airflow or reduce nasal resistance in selected growing children. • Is planned according to age, growth stage, bite, dental findings and imaging when indicated. • Is coordinated with ENT care when adenoid enlargement, allergy or nasal blockage remains.

Simple Home Practice (Only when nose is comfortably open)

Exercise	Instructions & Guidelines
1. Quiet Nasal Breathing	Sit upright, rest the tongue lightly on the palate, close the lips without strain and take 10 slow breaths through the nose.
2. Tongue Suction Hold	Place the whole tongue gently against the palate. Hold a light suction for 5 seconds and repeat 10 times without clenching.
3. Lip-Seal Practice	Hold a small paper strip between the lips - not the teeth - for 20 seconds while breathing quietly through the nose. Repeat 5 times.