CHRONIC PAIN & TMD & SLEEP, OH MY!

Maryland Sleep Society
Annual Conference
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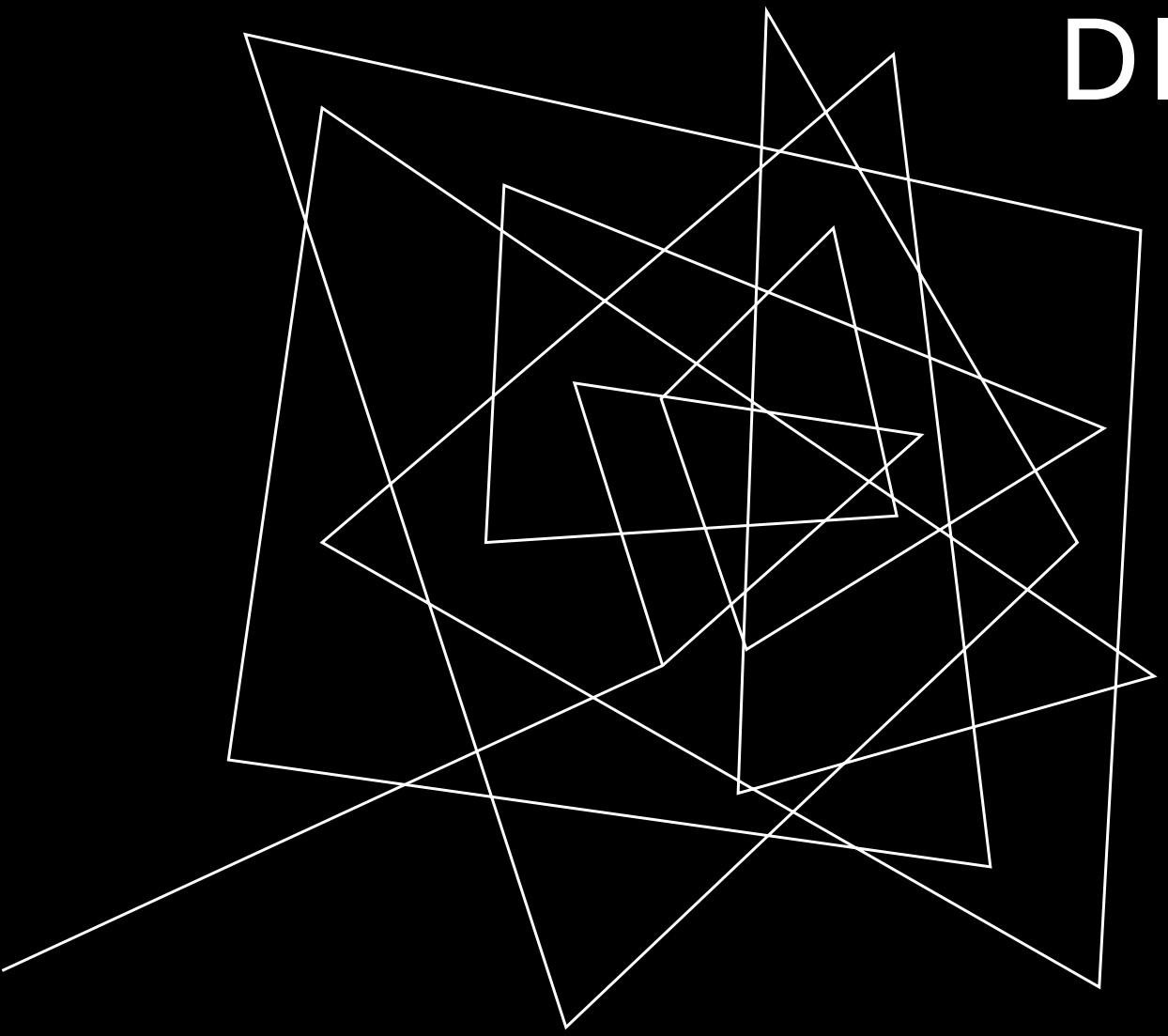


DISCLOSURES

I'm a contributing author to the AAOP's Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management, 6th & 7th eds. I do not receive compensation for this role.

This lecture may (*will*) include off-label uses for medications.

Ms. P: CC

“I’m tired of my jaw and teeth hurting”

Ms. P: Medical Hx

- 52yo female
- PMH: anxiety and counseling in college, allergic rhinitis
- ROS: earaches, depressed mood, non-restorative sleep
- PSH: appendectomy 10yrs ago
- Rx: Claritin qd, Benadryl for sleep about 2x/mo
- Fam Hx: HTN, osteoporosis
- Soc Hx: Works as a budget analyst for the DOD,

  denies tobacco, recreational drugs,
  reports 2 glasses of wine on the weekends

Ms. P: ROS

- No other joint or body pain
- No nausea, vomiting, aphasia, photophobia, phonophobia, or disability
- No history of headache, vision changes, dizziness, or autonomics like ptosis, lacrimation, rhinorrhea
- No EAM swelling or otorrhea
- No fever, chills, rash, or progressive neck stiffness
- No peripheral motor or sensory deficits, imbalance, neuropathy, mental status changes, or seizures

Ms. P: Clinical Exam

- Cranial nerves II-XII grossly intact
- Mandibular ROM grossly intact
- Scalloped tongue
- TMJ negative to palpation & auscultation
- Right masseter pain on maximal opening and palpation
- Palpation of right masseter replicates her CC and aggravates her lower right “toothache”

Kryger MH. Atlas of Clinical Sleep Medicine. 2nd ed. Philadelphia: Saunders; 2014: Fig 13.1-28.

Ms. P: Sleep screeners

- STOP-BANG: 2/8
- Epworth: 6/24
- 5’8”, 175 lbs = BMI 26.6

Chung F, Abdullah HR, Liao P. *STOP-Bang questionnaire: a practical approach to screen for obstructive sleep apnea*. Chest. 2016; 149(3):631-8.

Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y. *High STOP-Bang score indicates a high probability of obstructive sleep apnoea. British journal of anaesthesia*. 2012; 108(5):768-75.

Nagappa M, Liao P, Wong J, Auckley D, Ramachandran SK, Memtsoudis S, Mokhlesi B, Chung F. *Validation of the STOP-Bang questionnaire as a screening tool for obstructive sleep apnea among different populations: a systematic review and meta-analysis*. PloS one. 2015; 10(12):e0143697.

Zheng Z, Zhang Y, Chen M, Chen X, Li C, Wang C, Zhu J, Lin J, Ou X, Zou Z, Wang Z. *Application value of joint STOP-Bang questionnaire and Epworth Sleepiness Scale in screening for obstructive sleep apnea*. Frontiers in Public Health. 2022; 10:950585.

Ms. P: Sleep screeners

- STOP-BANG: 2/8
- Epworth: 6/24
- 5’8”, 175 lbs = BMI 26.6

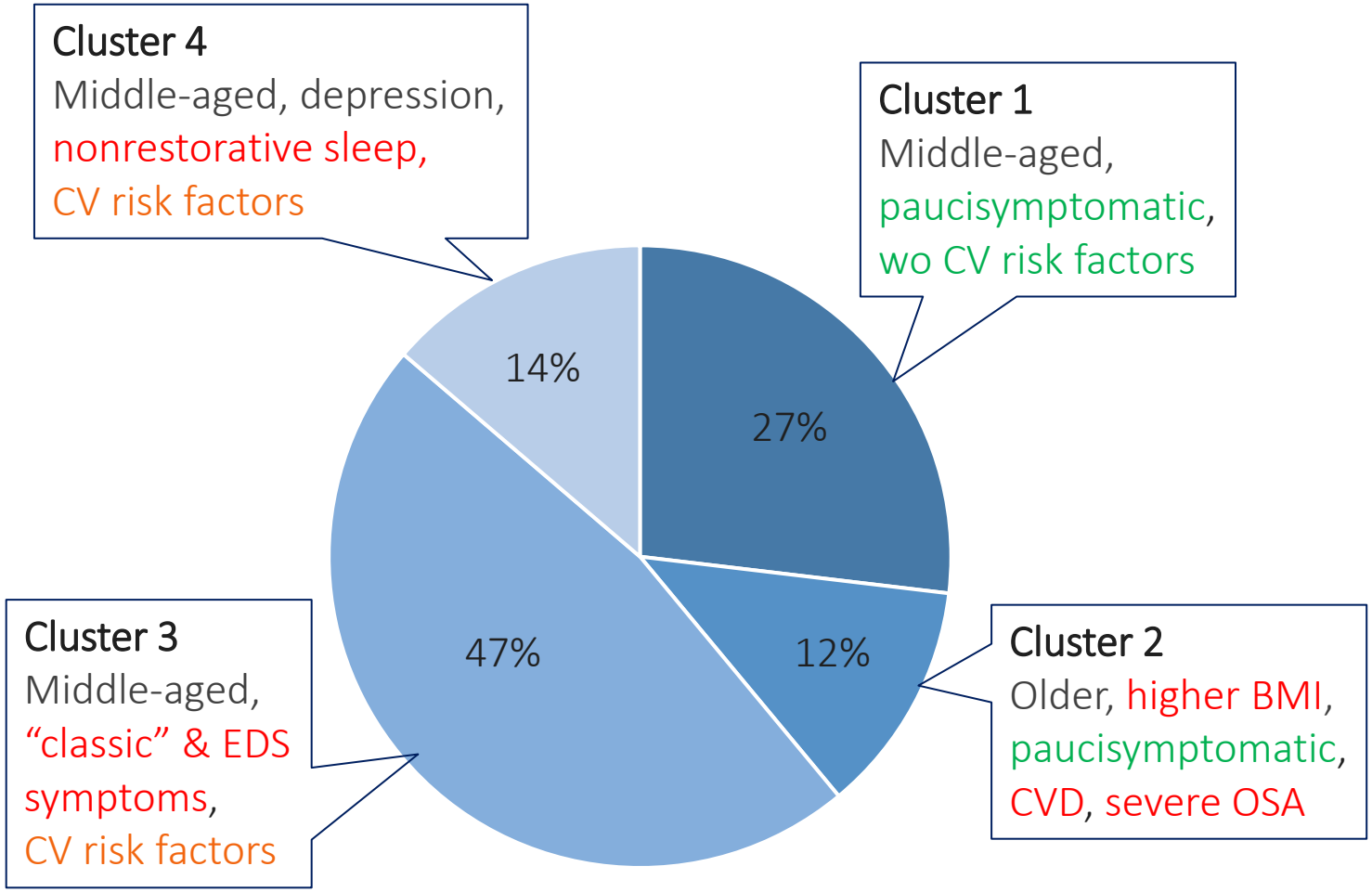
- Tongue scalloping predictive of sleep pathology in high-risk patients

Bailey DR. *Oral evaluation and upper airway anatomy associated with snoring and obstructive sleep apnea*. Dental Clinics of North America. 2001; 45(4):715-32.

Ruangsri S, Jorns TP, Puasiri S, Luecha T, Chaithap C, Sawanyawisuth K. *Which oropharyngeal factors are significant risk factors for obstructive sleep apnea? An age-matched study and dentist perspectives*. Nature and science of sleep. 2016; 8:215-9.

Weiss TM, Atanasov S, Calhoun KH. *The association of tongue scalloping with obstructive sleep apnea and related sleep pathology*. Otolaryngology—Head and Neck Surgery. 2005; 133(6):966-71.

OSA Phenotypes in Women



- n=1886 women w AHI ≥5 on PSG, cross-sectional cluster analysis
- Heterogenous phenotypes ~men
- Most prevalent phenotype was the "classic phenotype" of significant daytime sleepiness
- Paucisymptomatic presentations, with or without comorbidities
- Somnolence didn't correlate w AHI

Arbones EF, Oleo NS, Galmes MG, Ramos SP, Gala EP, Sánchez MC, Fontanet NP, Pérez SS, Ponsa CM. *Phenotypes of obstructive sleep apnea in women: A real-life cohort study*. Sleep Medicine. 2024; 121:295-302.

Sleep  Pain

- n=116,746 participants, random-effects meta-analyses of longitudinal cohort studies
- Sleep problems at baseline:
  - increase risk of chronic musculoskeletal pain short term (OR 1.64, 95% CI 1.01–2.65)
  - increase risk of chronic musculoskeletal pain long term (OR 1.39, 95% CI 1.21–1.59)
- Chronic musculoskeletal pain at baseline:
  - may increase the risk of short-term sleep problems (OR 1.56, 95% CI 1.02–2.38)
  - evidence for long-term sleep problems was very uncertain
  - impact of only local or only widespread pain on short-term sleep problems was very uncertain
  - widespread pain may elevate the risk of long-term sleep problems (OR 2.0, 95% CI 1.81–2.21)

Runge N, Ahmed I, Saueressig T, Perea J, Labie C, Mairesse O, Nijs J, Malfliet A, Verschueren S, Van Assche D, de Vlam K. *The bidirectional relationship between sleep problems and chronic musculoskeletal pain: a systematic review with meta-analysis*. Pain. 2024; 165(11):2455-67.

- As many as five of six patients with orofacial pain can present with sleep problems
  - Insomnia
  - OSA
  - Restless legs syndrome (RLS)
  - Periodic Limb Movements (PLM)
  - Sleep bruxism
  - Circadian rhythm sleep–wake disorders
  - REM sleep behaviour disorder, CSA, narcolepsy

McCloy K, Herrero Babiloni A, Sessle BJ. *Sleep disorders and orofacial pain: insights for dental practice*. Australian Dental Journal. 2024; in press.

Sleep  Pain

- n=80 with AHI ≥15, n=70 healthy controls
- Pain prevalence 57.5% in OSA vs 27.1% in HC (*p<0.001*)
- Pain ratings correlated w higher ESS scores and lower SpO2 nadirs
- AHI≥60 had OR 7.0 for pain (*p=0.041*)
- 26 of 46 were CPAP compliant: had significant improvement in pain scores (*p<0.001*)

Shen C, Ou Y, Ouyang R, Zong D. *Prevalence and characteristics of pain in moderate-to-severe obstructive sleep apnea patients and effect of CPAP treatment*. Scientific Reports. 2023; 13(1):15758.

- n=10,412 cross-sectional Tromsø 6 study
- Impaired sleep ↑ risk for reduced pain tolerance
- Frequency & severity of insomnia, sleep onset latency, and poor sleep efficiency were associated with pain sensitivity in a dose–response manner

Sivertsen B, Lallukka T, Petrie KJ, Steingrímsdóttir ÓA, Stubhaug A, Nielsen CS. *Sleep and pain sensitivity in adults*. Pain. 2015; 156(8):1433-9.

- n=337 consecutive TMD patients
- Myogenous & mixed TMD patients had worse PSQI scores than just arthrogenous TMD

Lee YH, Auh QS. *Comparison of sleep quality deterioration by subgroup of painful temporomandibular disorder based on diagnostic criteria for temporomandibular disorders*. Scientific Reports. 2022; 12(1):9026.

- n=858,226 young veterans
- 10.6% diagnosis of OSA, 27.8% reported moderate/severe pain
- With OSA were more likely to report pain (OR 1.09, 95% CI 1.08–1.11)

Athar W, Card ME, Charokopos A, Akgün KM, DeRycke EC, Haskell SG, Yaggi HK, Bastian LA. *Obstructive sleep apnea and pain intensity in young adults*. Annals of the American Thoracic Society. 2020; 17(10):1273-8.

- n=286, case control
- TMD patients have poorer subjective sleep quality than healthy controls

Benoliel R, Zini A, Zakuto A, Slutzky H, Haviv Y, Sharav Y, Almoznino G. *Subjective Sleep Quality in Temporomandibular Disorder Patients and Association with Disease Characteristics and Oral Health-Related Quality of Life*. Journal of Oral & Facial Pain & Headache. 2017; 31(4):313-22.

Sleep disturbance precedes pain…

- Sleep fragmentation modulates experimental pain perception in young, healthy women
- The effects of sleep disruption on pain are magnified after a second night of sleep fragmentation

  Iacovides S, George K, Kamerman P, Baker FC. *Sleep fragmentation hypersensitizes healthy young women to deep and superficial experimental pain*. The Journal of Pain. 2017; 18(7):844-54.

- Sleep restriction lowers mechanical pain threshold in the orofacial region

  Kamiyama H, Iida T, Nishimori H, Kubo H, Uchiyama M, De Laat A, Lavigne G, Komiyama O. *Effect of sleep restriction on somatosensory sensitivity in the oro-facial area: An experimental controlled study*. Journal of Oral Rehabilitation. 2019; 46(4):303-9.

- n=2,453 OPPERA prospective cohort, n=220 incident TMD cases
- Risk of TMD was greater among participants whose PSQI scores worsened during follow-up (HR 1.73, 95% CI 1.29–2.32)

  Sanders AE, Akinkugbe AA, Bair E, Fillingim RB, Greenspan JD, Ohrbach R, Dubner R, Maixner W, Slade GD. *Subjective sleep quality deteriorates before development of painful temporomandibular disorder*. The Journal of Pain. 2016; 17(6):669-77.

Addressing sleep improves pain…

- Hypoxemia associated with increased pain intensity
- CPAP treatment improved in pain outcomes

  Charokopos A, Card ME, Gunderson C, Steffens C, Bastian LA. *The association of obstructive sleep apnea and pain outcomes in adults: a systematic review*. Pain Medicine. 2018; 19:S69-75.

- n=80 with AHI ≥15, n=70 healthy controls
- Pain prevalence 57.5% in OSA vs 27.1% in HC ($p<0.001$)
- Pain ratings correlated w higher ESS scores and lower SpO2 nadirs
- AHI≥60 had OR 7.0 for pain ($p=0.041$)
- 26 of 46 were CPAP compliant: had significant improvement in pain scores ($p<0.001$)

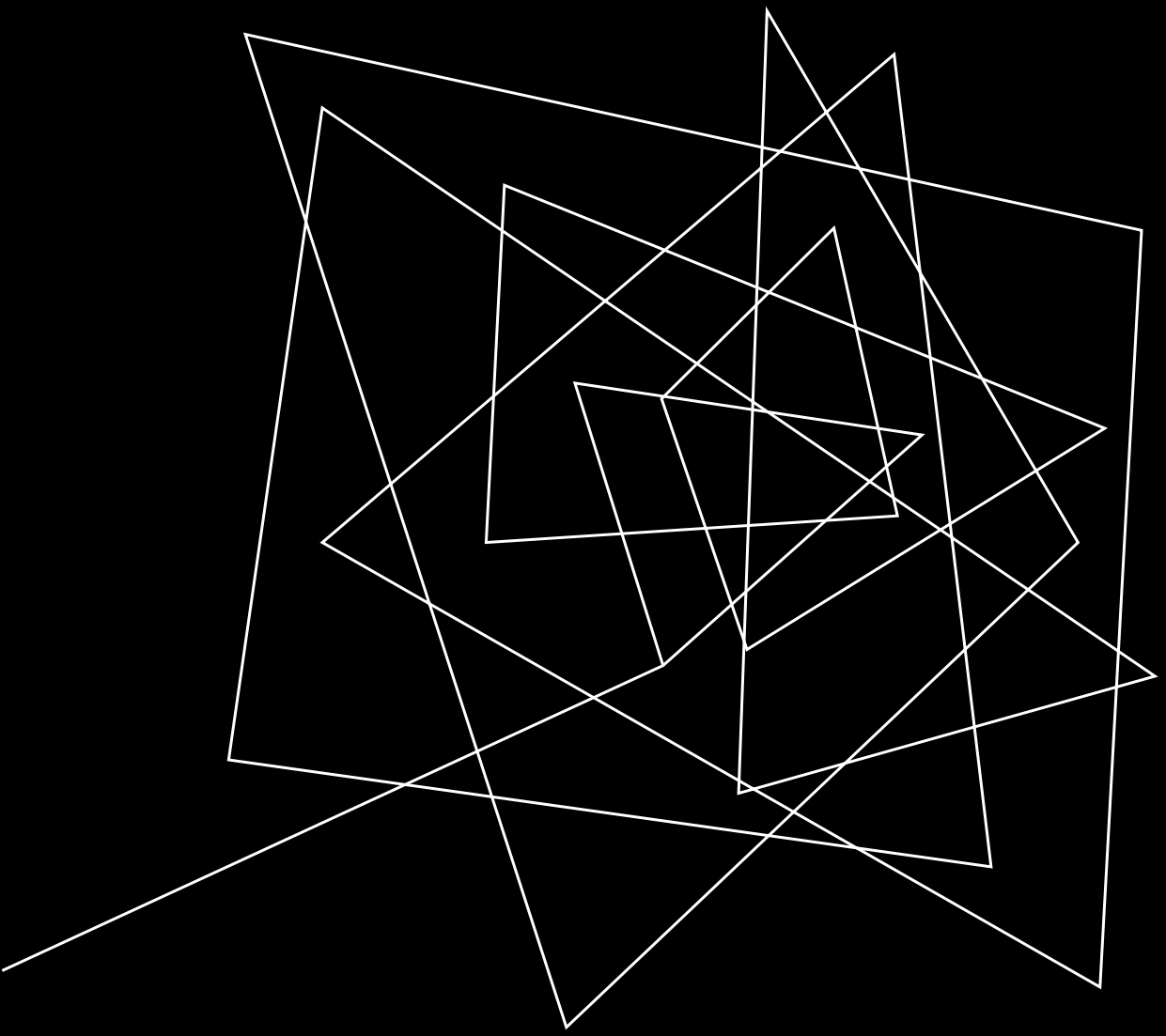
  Shen C, Ou Y, Ouyang R, Zong D. *Prevalence and characteristics of pain in moderate-to-severe obstructive sleep apnea patients and effect of CPAP treatment*. Scientific Reports. 2023; 13(1):15758.

- n=12 with severe OSA and no history of pain
- CPAP reduced AHI from 50.9 ± 14.5 to 1.4 ± 1.0 and pain tolerance increased
- 2-night CPAP discontinuation showed reduced pain tolerance

  Khalid I, Roehrs TA, Hudgel DW, Roth T. *Continuous positive airway pressure in severe obstructive sleep apnea reduces pain sensitivity*. Sleep. 2011; 34(12):1687-91.

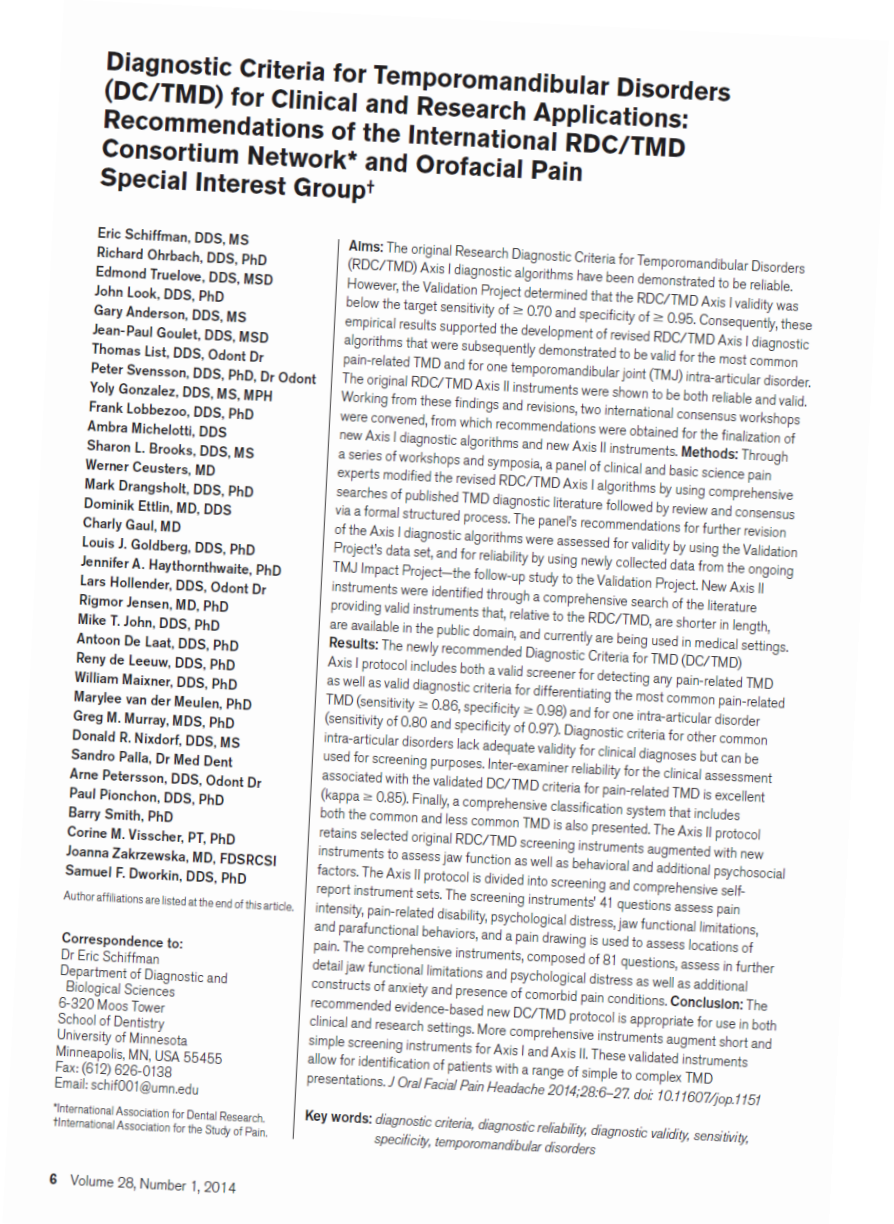
- n=40 consecutive OSA patients, 18mo prospective cohort
- 33 underwent OSA treatment
  - mean AHI reduced 21.9 ± 13.1 to 8.4 ± 4.7 ($p<0.05$)
  - 11 presented with pain-related TMD
  - 8 had significant improvement or pain resolution

  Alessandri-Bonetti A, Lobbezoo F, Mangino G, Aarab G, Gallenzi P. *Obstructive sleep apnea treatment improves temporomandibular disorder pain*. Sleep and Breathing. 2024; 28(1):203-9.



Referral for sleep evaluation…

“But Dr. Google says I have TMJ…”



Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†

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Antoon De Laat, DDS, PhD
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William Maixner, DDS, PhD
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†International Association for the Study of Pain.

Aims: The original Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I diagnostic algorithms have been demonstrated to be reliable. However, the Validation Project determined that the RDC/TMD Axis I validity was below the target sensitivity of ≥ 0.70 and specificity of ≥ 0.95. Consequently, these empirical results supported the development of revised RDC/TMD Axis I diagnostic algorithms that were subsequently demonstrated to be valid for the most common pain-related TMD and for one temporomandibular joint (TMJ) intra-articular disorder. The original RDC/TMD Axis II instruments were shown to be both reliable and valid. Working from these findings and revisions, two international consensus workshops were convened, from which recommendations were obtained for the finalization of new Axis I diagnostic algorithms and new Axis II instruments. **Methods:** Through a series of workshops and symposia, a panel of clinical and basic science pain experts modified the revised RDC/TMD Axis I algorithms by using comprehensive searches of published TMD diagnostic literature followed by review and consensus via a formal structured process. The panel's recommendations for further revision of the Axis I diagnostic algorithms were assessed for validity by using the Validation Project's data set, and for reliability by using newly collected data from the ongoing TMJ Impact Project—the follow-up study to the Validation Project. New Axis II instruments were identified through a comprehensive search of the literature providing valid instruments that, relative to the RDC/TMD, are shorter in length, are available in the public domain, and currently are being used in medical settings. **Results:** The newly recommended Diagnostic Criteria for TMD (DC/TMD) Axis I protocol includes both a valid screener for detecting any pain-related TMD as well as valid diagnostic criteria for differentiating the most common pain-related TMD (sensitivity ≥ 0.86, specificity ≥ 0.98) and for one intra-articular disorder (sensitivity of 0.80 and specificity of 0.97). Diagnostic criteria for other common intra-articular disorders lack adequate validity for clinical diagnoses but can be used for screening purposes. Inter-examiner reliability for the clinical assessment associated with the validated DC/TMD criteria for pain-related TMD is excellent (kappa ≥ 0.85). Finally, a comprehensive classification system that includes both the common and less common TMD is also presented. The Axis II protocol retains selected original RDC/TMD screening instruments augmented with new instruments to assess jaw function as well as behavioral and additional psychosocial factors. The Axis II protocol is divided into screening and comprehensive self-report instrument sets. The screening instruments' 41 questions assess pain intensity, pain-related disability, psychological distress, jaw functional limitations, and parafunctional behaviors, and a pain drawing is used to assess locations of pain. The comprehensive instruments, composed of 81 questions, assess in further detail jaw functional limitations and psychological distress as well as additional constructs of anxiety and presence of comorbid pain conditions. **Conclusion:** The recommended evidence-based new DC/TMD protocol is appropriate for use in both clinical and research settings. More comprehensive instruments augment short and simple screening instruments for Axis I and Axis II. These validated instruments allow for identification of patients with a range of simple to complex TMD presentations. *J Oral Facial Pain Headache 2014;28:6–27. doi: 10.11607/jop.1151*

Key words: *diagnostic criteria, diagnostic reliability, diagnostic validity, sensitivity, specificity, temporomandibular disorders*

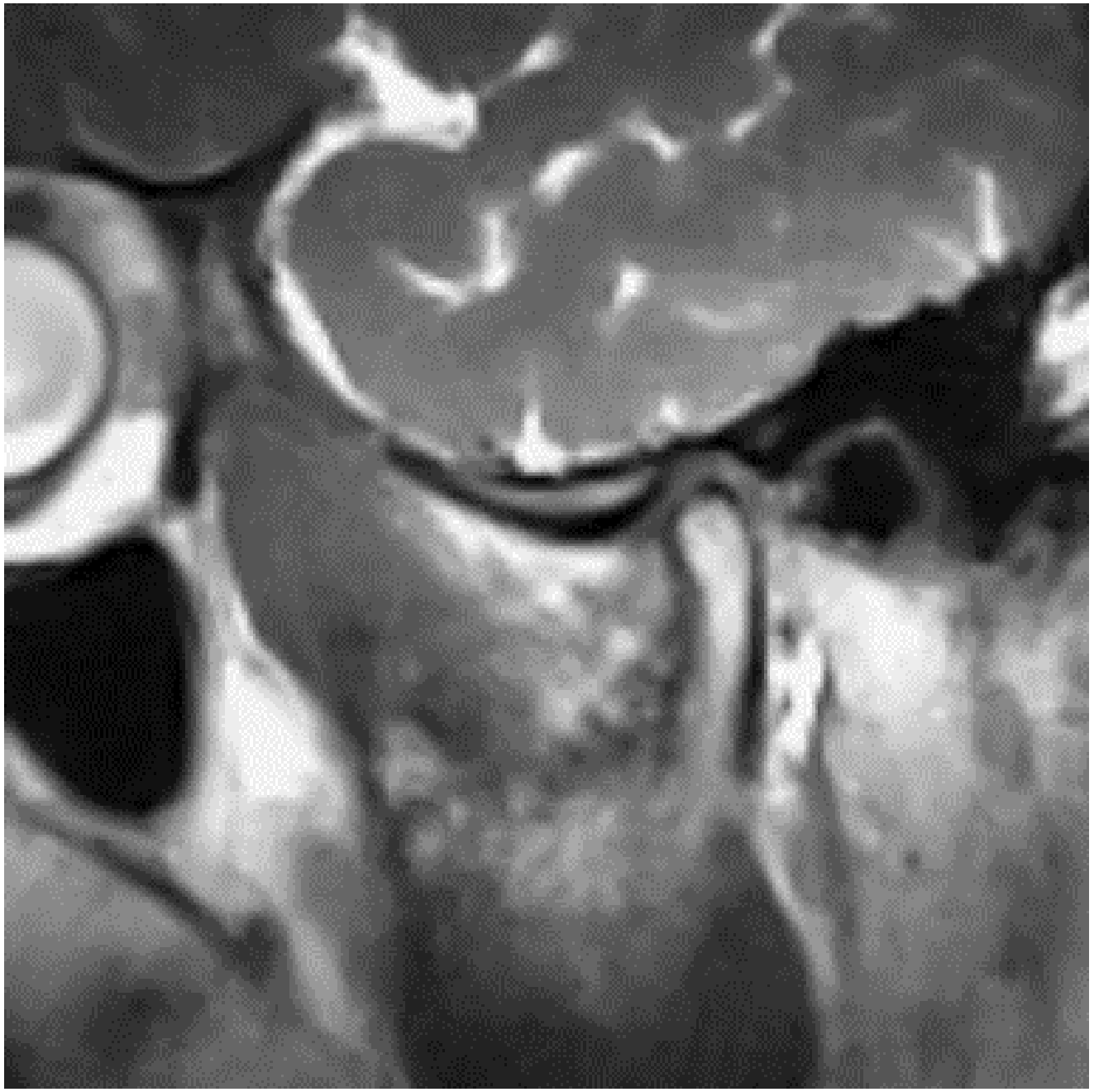
Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Normal TMJ Disc-Condyle Complex

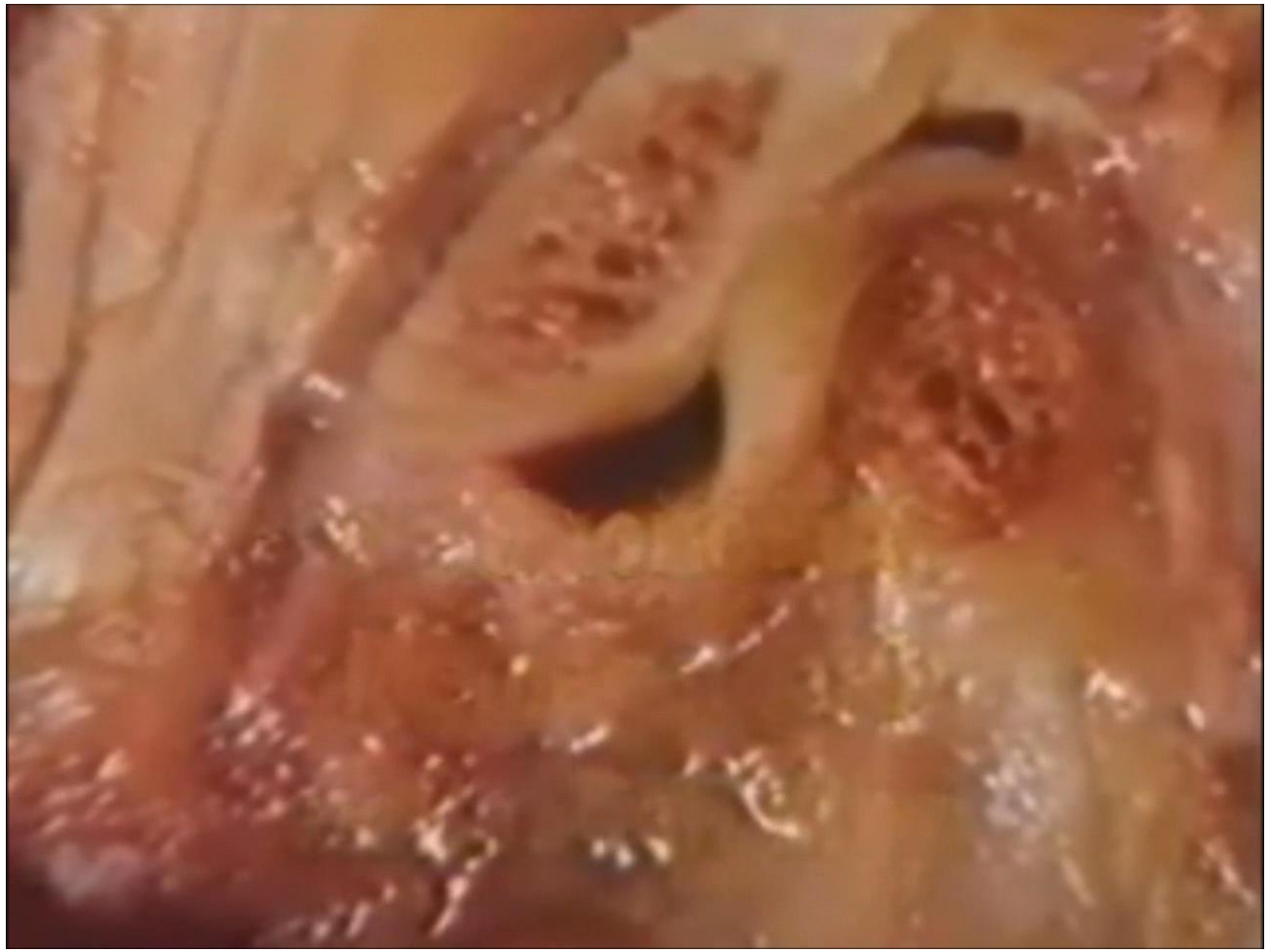
Westesson P, Eriksson L. Condylar and Disk Movements in Dissected TMJ Autopsy Specimens; 1985.

Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Normal TMJ Disc-Condyle Complex: MRI



Disc displacement with reduction



Westesson P, Eriksson L. Condylar and Disk Movements in Dissected TMJ Autopsy Specimens; 1985.

Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Disc displacement without reduction…

with limited opening

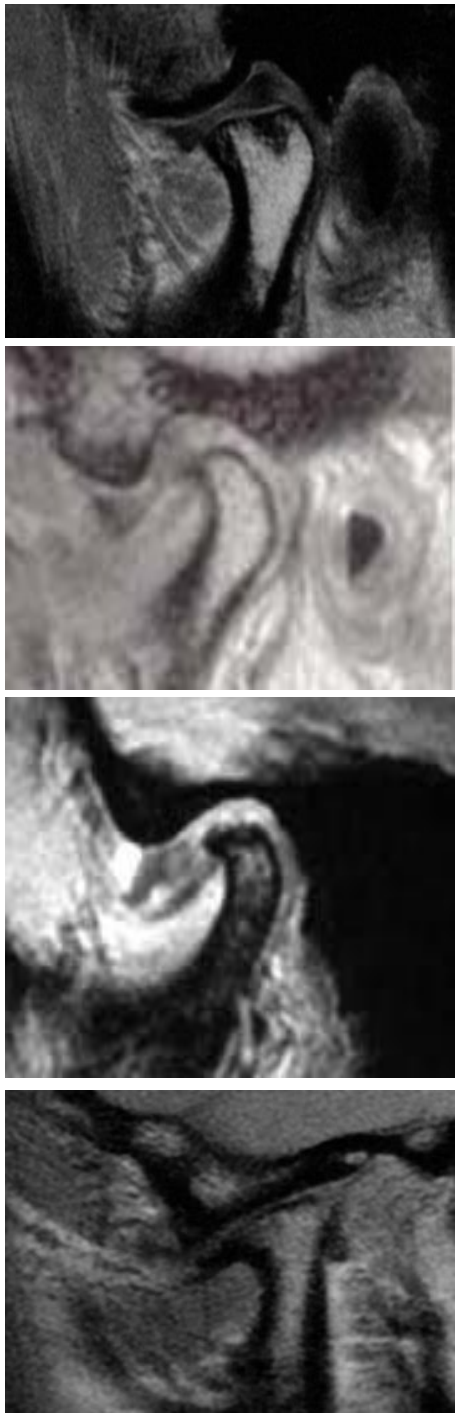
Westesson P, Eriksson L. Condylar and Disk Movements in Dissected TMJ Autopsy Specimens; 1985.

Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Degenerative Joint Disease (DJD)

- Hx:
  - TMJ noise with jaw movement

    OR
  - Reported TMJ noise during exam
- Exam:
  - Palpable crepitus during jaw movement
  - Auscultation: crunching, grinding, grating
- MRI: erosion, sclerosis, osteophyte



Arvidsson LZ, et al. *Temporomandibular Joint Findings in Adults with Long-standing Juvenile Idiopathic Arthritis: CT and MR Imaging Assessment*. Radiology 2010;256(1):191-200.
Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

TMJ Longitudinal Stability?

- n=789 TMJs with soft tissue (disc displacement) on MRI
- n=794 TMJs with hard tissue (DJD) on CT
- 8 years later:
  - 76% of baseline TMJ soft tissue diagnoses remained stable
  - 71% of the baseline hard tissue diagnoses remained stable
- Reversal and progression seen in ~10-15% for both soft and hard tissues

Schiffman EL, Ahmad M, Hollender L, Kartha K, Ohrbach R, Truelove EL, Zhang L, Hodges JS, Sommers E, Anderson GC, Gonzalez YM. *Longitudinal stability of common TMJ structural disorders*. Journal of Dental Research. 2017; 96(3):270-6.

Arthralgia

- Hx:
  - Pain in jaw, temple, ear, preauricular

    AND
  - Pain modified by jaw movement
- Exam:
  - Pain familiar to CC produced by:
    - Palpation of condyle

      OR
    - Jaw movement (maximal opening or excursives)

Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Myogenous Pain

Local myalgia

- Pain in jaw, temple, ear, preauricular
- Pain modified by jaw function, movement, parafunction
- Familiar pain with palpation of masseter/temporalis or maximal opening
- **Localized to palpation site**

Myofascial pain

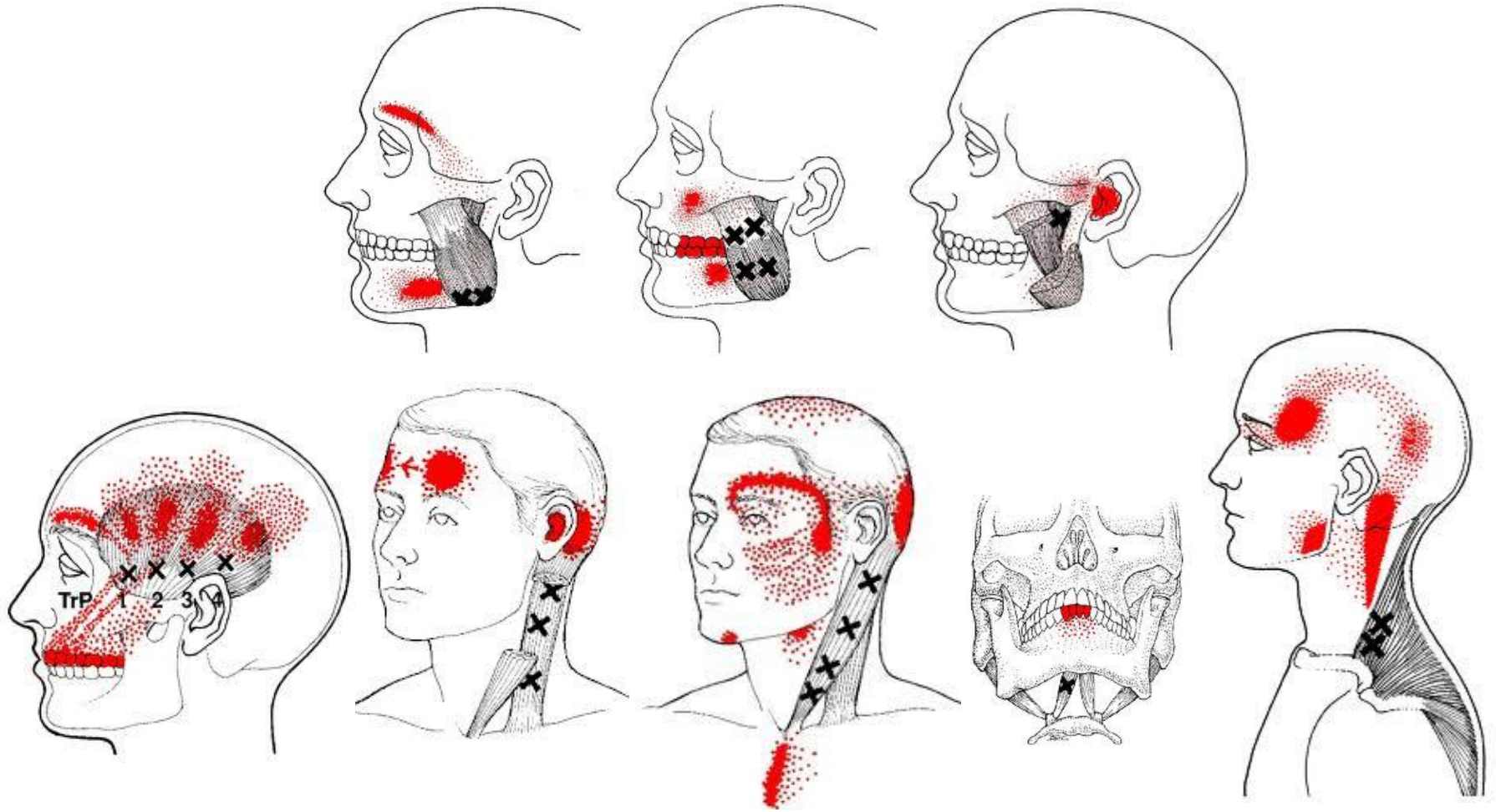
- Pain in jaw, temple, ear, preauricular
- Pain modified by jaw function, movement, parafunction
- Familiar pain with palpation of masseter/temporalis or maximal opening
- **Pain spreads beyond palpation site but still within muscle**

Myofascial pain with referral

- Pain in jaw, temple, ear, preauricular
- Pain modified by jaw function, movement, parafunction
- Familiar pain with palpation of masseter/temporalis or maximal opening
- **Pain spreads beyond muscle boundary**

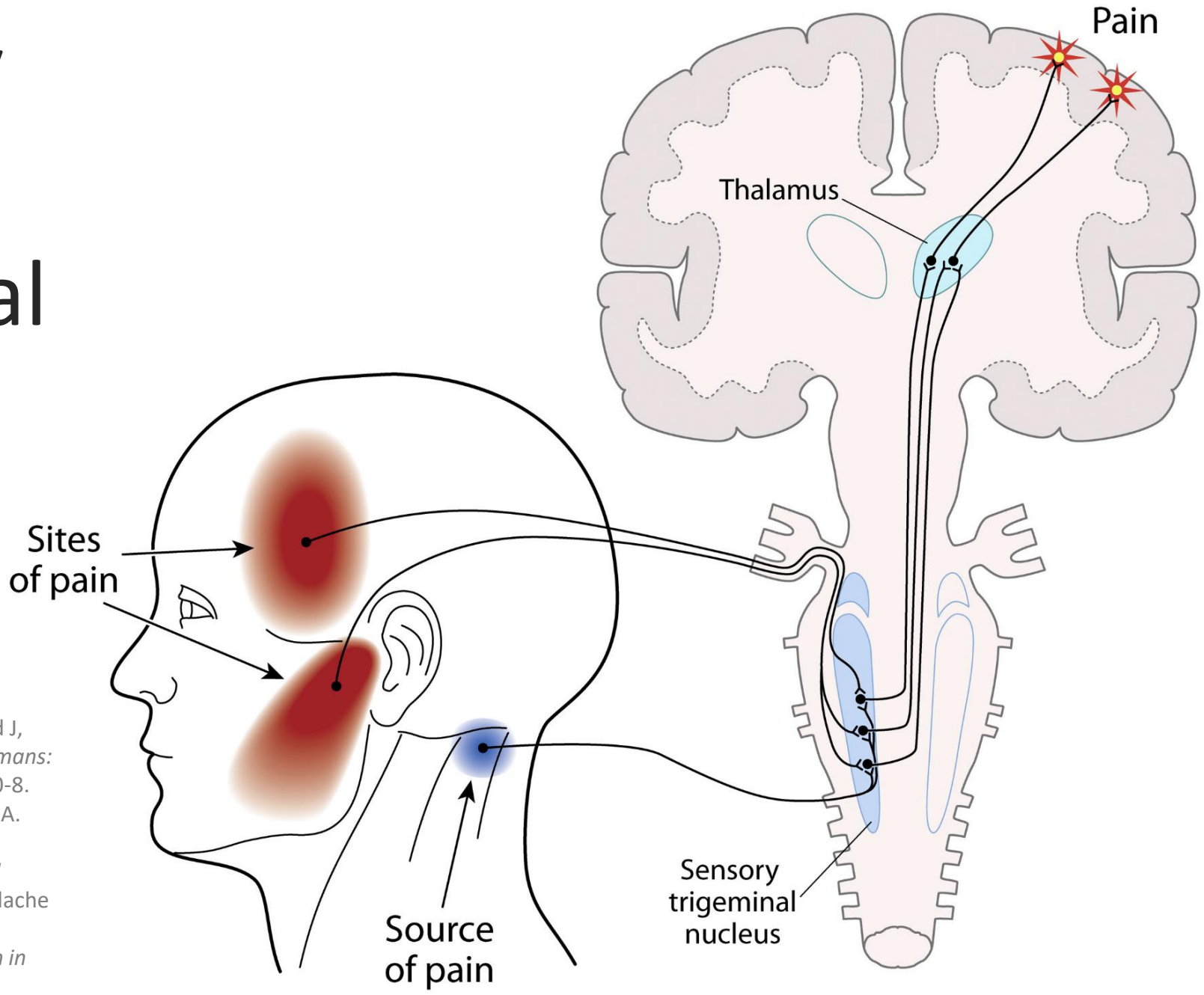
Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A. *Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network [IADR] and Orofacial Pain Special Interest Group [IASP]*. J Oral Facial Pain Headache 2014;28(1):6-27.

Myofascial Pain with Referral: Trigeminal Referral Patterns



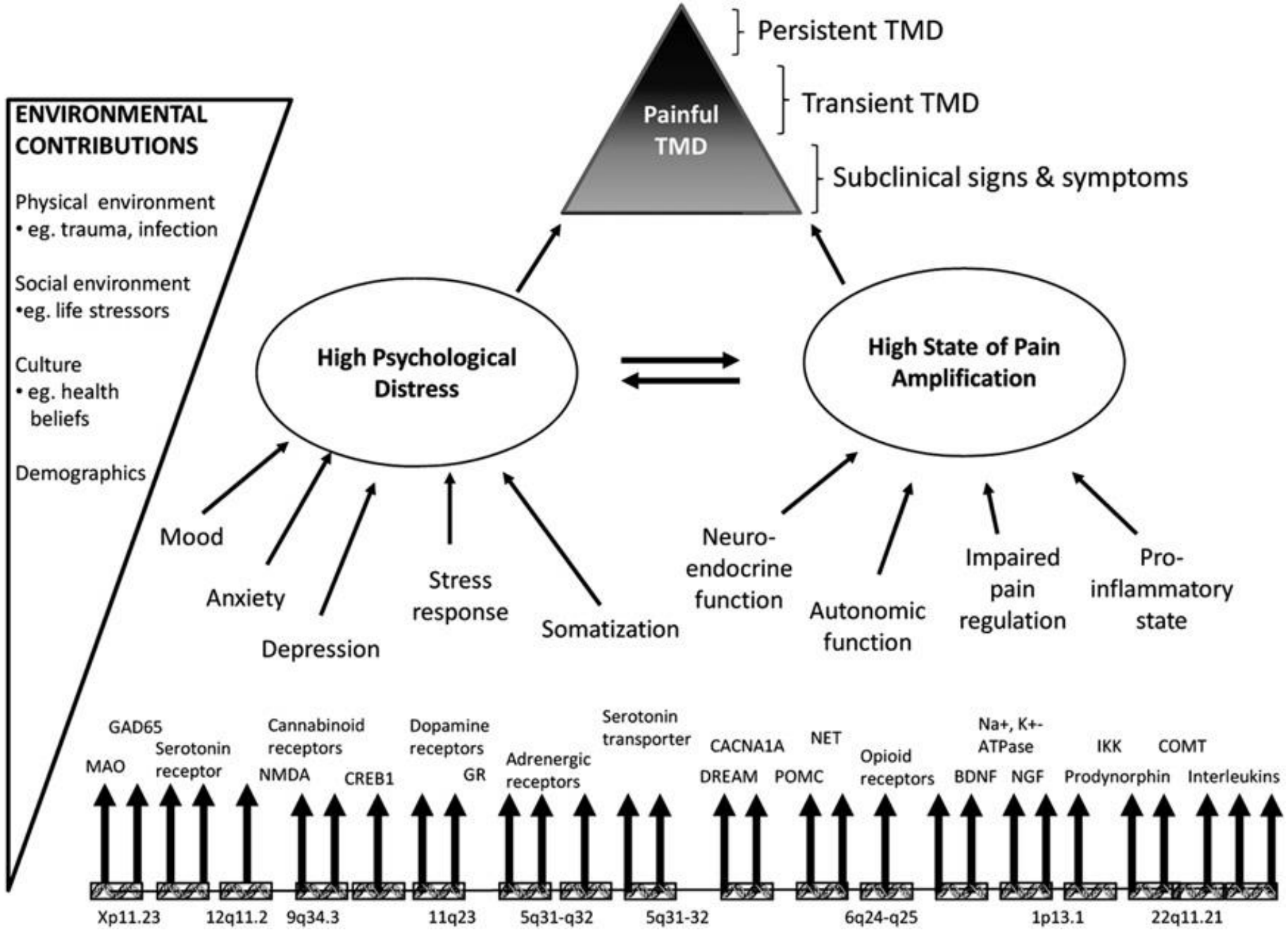
Simons DG, Travell JG. Myofascial Pain and Dysfunction: The Trigger Point Manual. vol. 1; 2nd ed. Philadelphia: Lippincott, Williams & Wilkins; 1998.

Neuroanatomy of Referred Musculoskeletal Pain



Fontaine D, Almairac F, Santucci S, Fernandez C, Dallel R, Pallud J, Lanteri-Minet M. *Dural and pial pain-sensitive structures in humans: new inputs from awake craniotomies*. Brain. 2018; 141(4):1040-8.
Wright EF. *Referred orofacial pain from the cervical region*. JADA. 2016; 147(9):749-751.
Bartsch T, Goadsby PJ. *Anatomy and physiology of pain referral patterns in primary and cervicogenic headache disorders*. Headache Currents. 2005; 2(2):42-8.
Wirth FP, Van Buren JM. *Referral of pain from dural stimulation in man. Journal of neurosurgery*. 1971; 34(5):630-42.

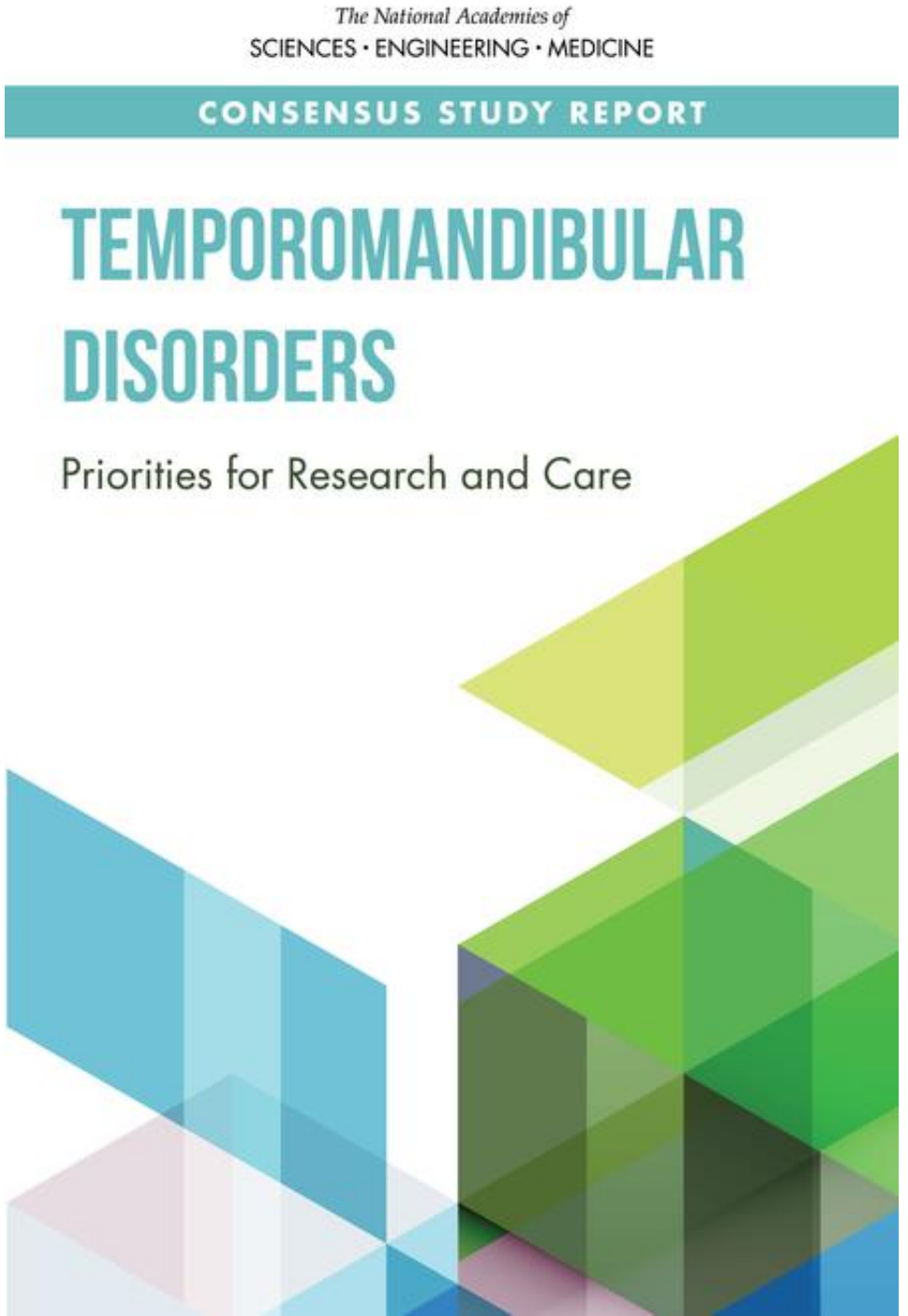
OPPERA Chronic TMD Model



Maixner W, Diatchenko L, Dubner R, Fillingim RB, Greenspan JD, Knott C, Ohrbach R, Weir B, Slade GD. *Orofacial Pain Prospective Evaluation and Risk Assessment Study – The OPPERA Study*. J Pain 2011; 12(11, Supplement):T4-T11.e12.

NASEM 2020 Report

- Research demonstrates that TMDs are complex multi-system disorders, which points to the need for a different, patient-centered, interprofessional approach to TMD research and treatment
- Traditional dental-centric approaches must be modernized



Greene CS, Kusiak JW, Cowley T, Cowley AW. *Recently Released Report by Major Scientific Academy Proposes Significant Changes in Understanding and Managing TMDs*. Journal of Oral and Maxillofacial Surgery. 2022; 80(1):8-9.

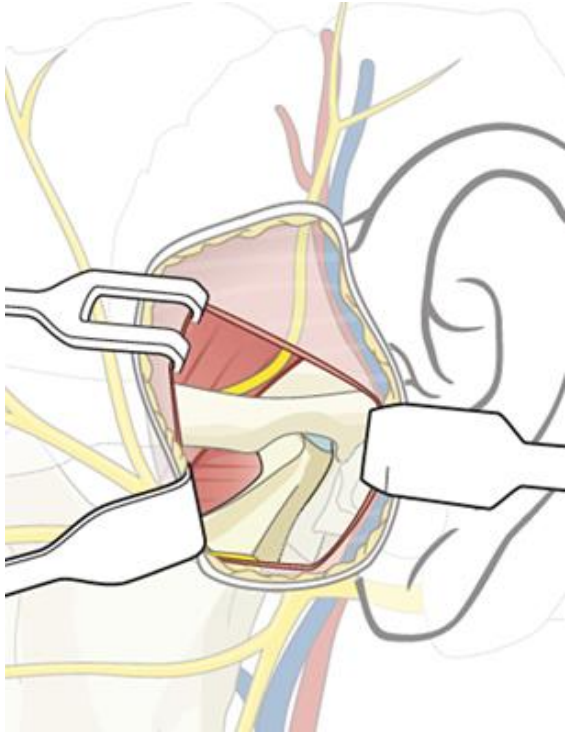
National Academies of Sciences, Engineering, and Medicine. *Temporomandibular Disorders: Priorities for Research and Care*. Washington, DC: The National Academies Press. 2020.

Does Ms. P need jaw surgery?

Does Ms. P need jaw surgery?

- n=106, RCT of closed lock TMD patients
  - Medical management
  - Physical rehabilitation
  - Arthroscopic surgery with rehabilitation
  - Arthroplasty with rehabilitation
- All groups showed improvement
- No between-group differences at 6, 12, 18, 24, and 60 months post-op
- Simple, conservative, reversible treatment is best as INITIAL treatment

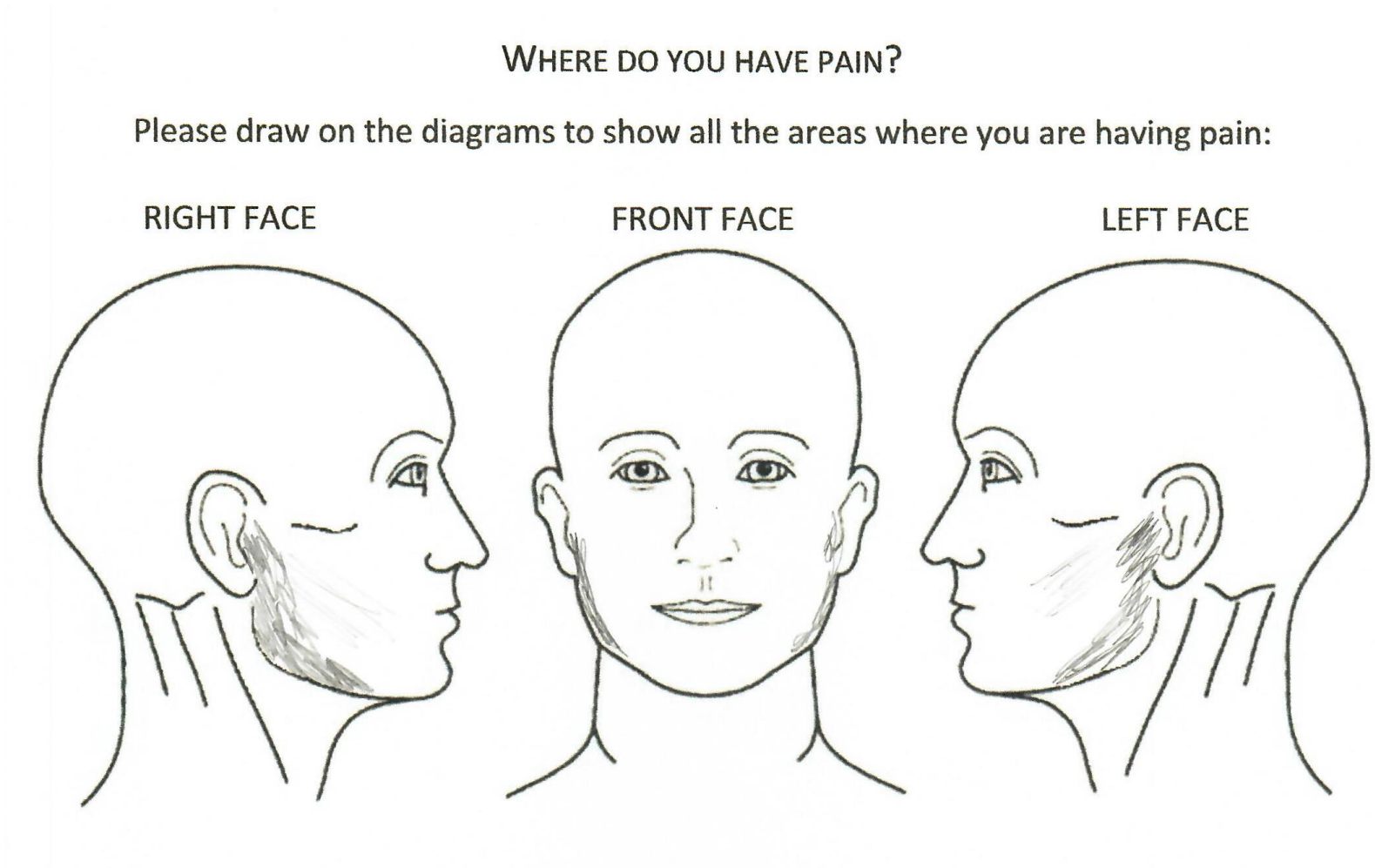
Hossameldi, et al. Int JOMS. 2018.



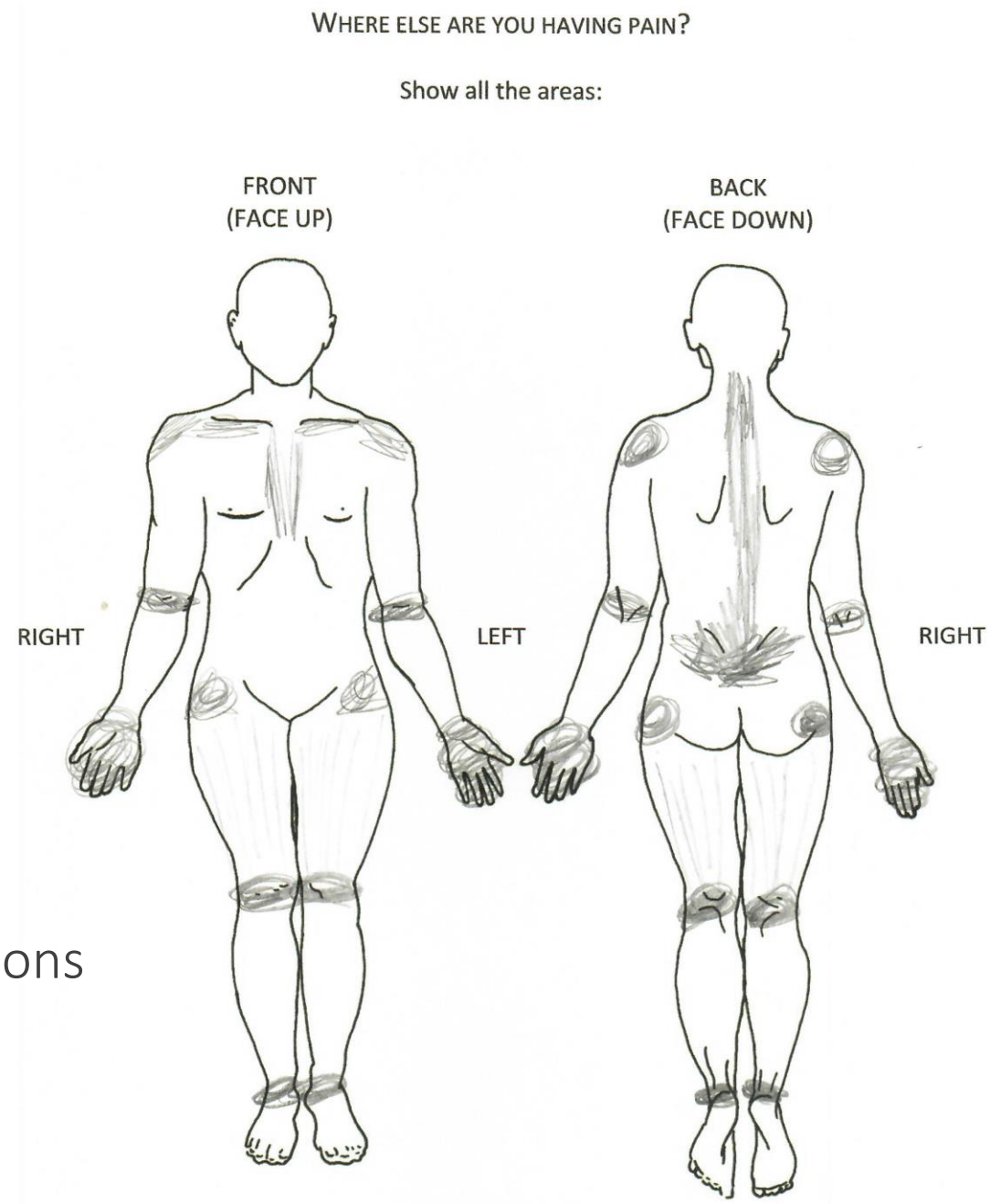
AO Foundation

Schiffman EL, et al. Randomized Effectiveness Study of Four Therapeutic Strategies for TMJ Closed Lock. JDR. **2007**; 86:58-63.
Schiffman EL, et al. Effects of four treatment strategies for temporomandibular joint closed lock. Int J OMFS. **2014**; 43(2):217-226.

“TMJ patient”?


WHERE DO YOU HAVE PAIN?
Please draw on the diagrams to show all the areas where you are having pain:
RIGHT FACE
FRONT FACE
LEFT FACE

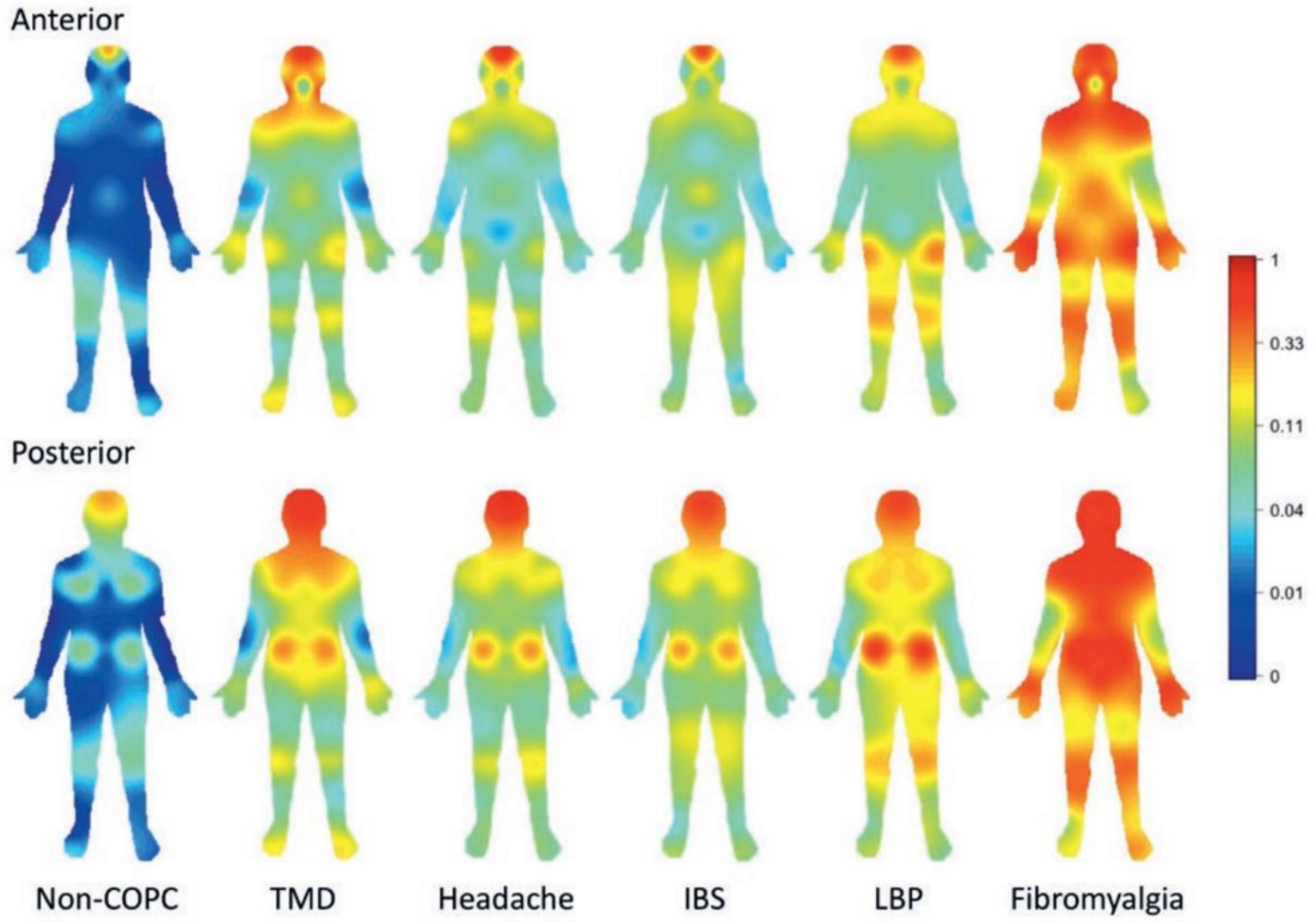
…or something more?



- N=423 consecutive new TMD patients
- 91.5% reported multiple extracranial pain regions

Hawkins JM, Schmidt JE, Hargitai IA, Johnson JF, Howard RS, Bertrand PM. *Multimodal assessment of body pain in orofacial pain patients*. Pain Medicine. 2016; 17(5):961-9.

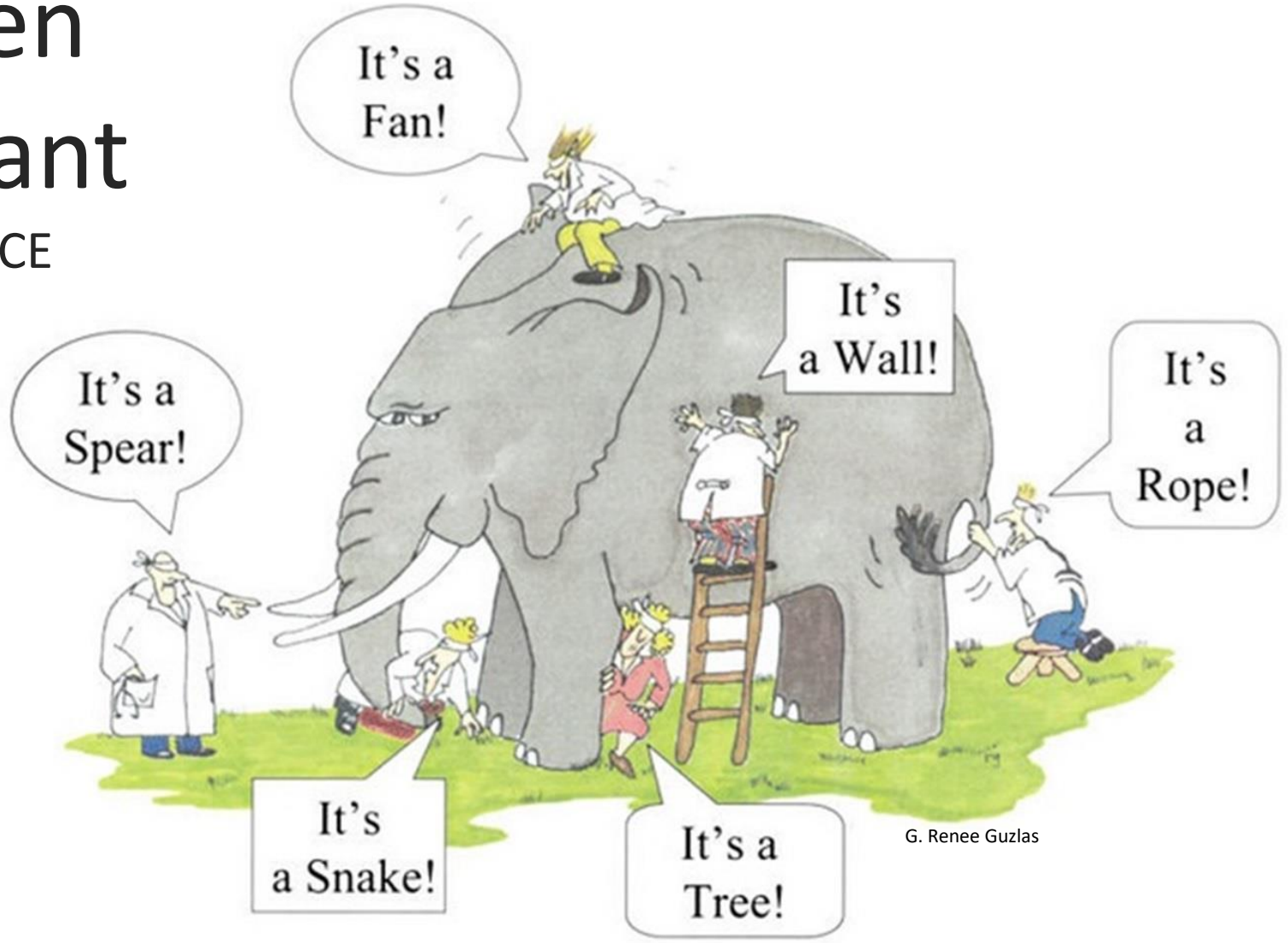
Chronic Overlapping Pain Conditions



Ohrbach R, Sharma S, Fillingim RB, Greenspan JD, Rosen JD, Slade GD. *Clinical Characteristics of Pain Among Five Chronic Overlapping Pain Conditions*. Journal of Oral & Facial Pain and Headache. 2020; 34:s29-42.

The blind men and an elephant

Hindu parable, c. 500 BCE



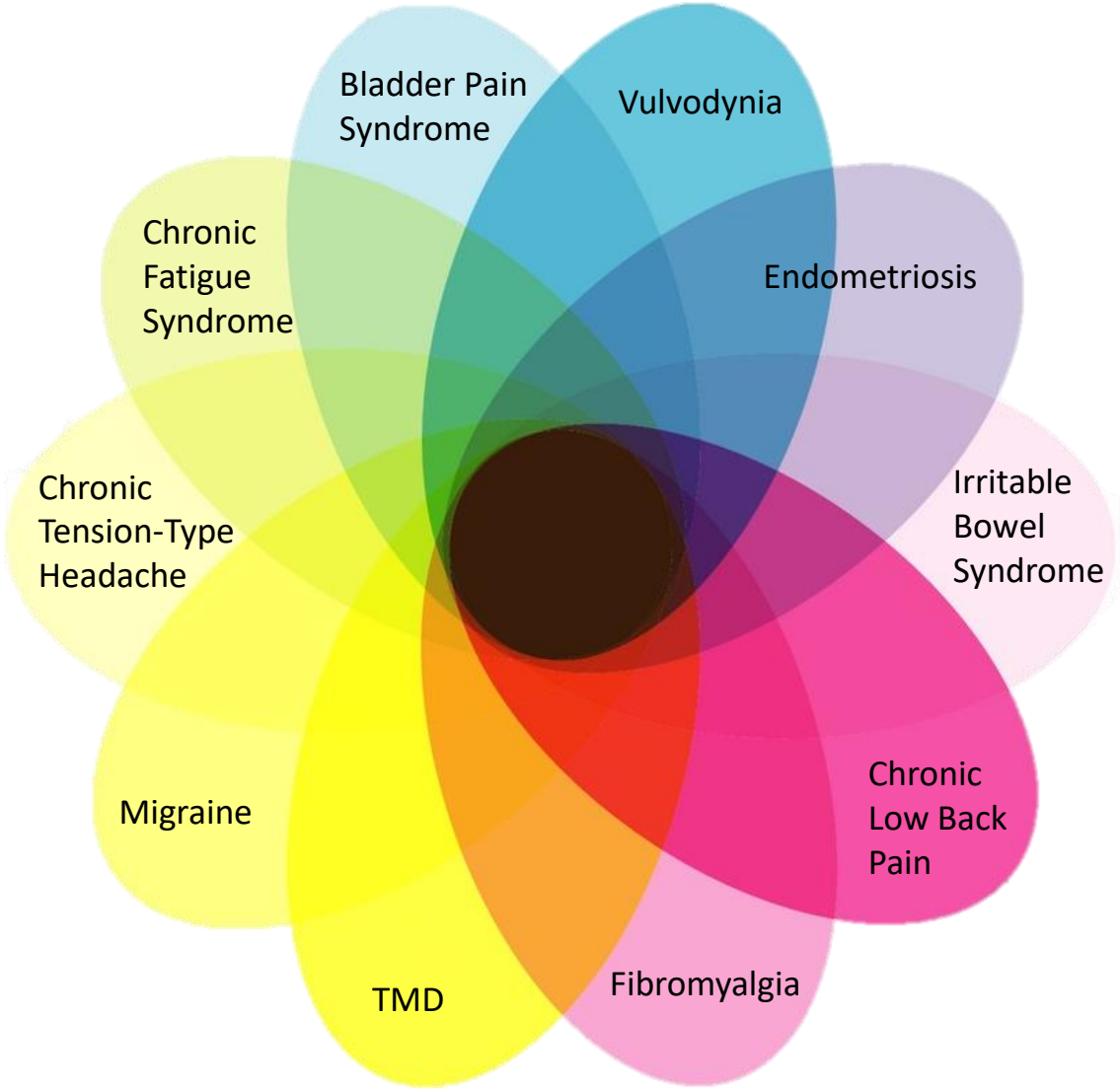
"And so these men of Indostan
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!"

John Godfrey Saxe (1816-1887)

Himmelfarb J, Stenvinkel P, Ikizler TA, Hakim RM. The elephant in uremia: oxidant stress as a unifying concept of cardiovascular disease in uremia. Kidney International. 2002; 62(5):1524-38.

COPCs

- Pathophysiologic mechanisms underpinning COPCs now point to sensitization at many levels of the nervous system, clinically expressed as **nociplastic pain**
- Accompanied by constitutional features:
  - Fatigue
  - Sleep disturbance
  - Hypervigilance
  - Anxiety

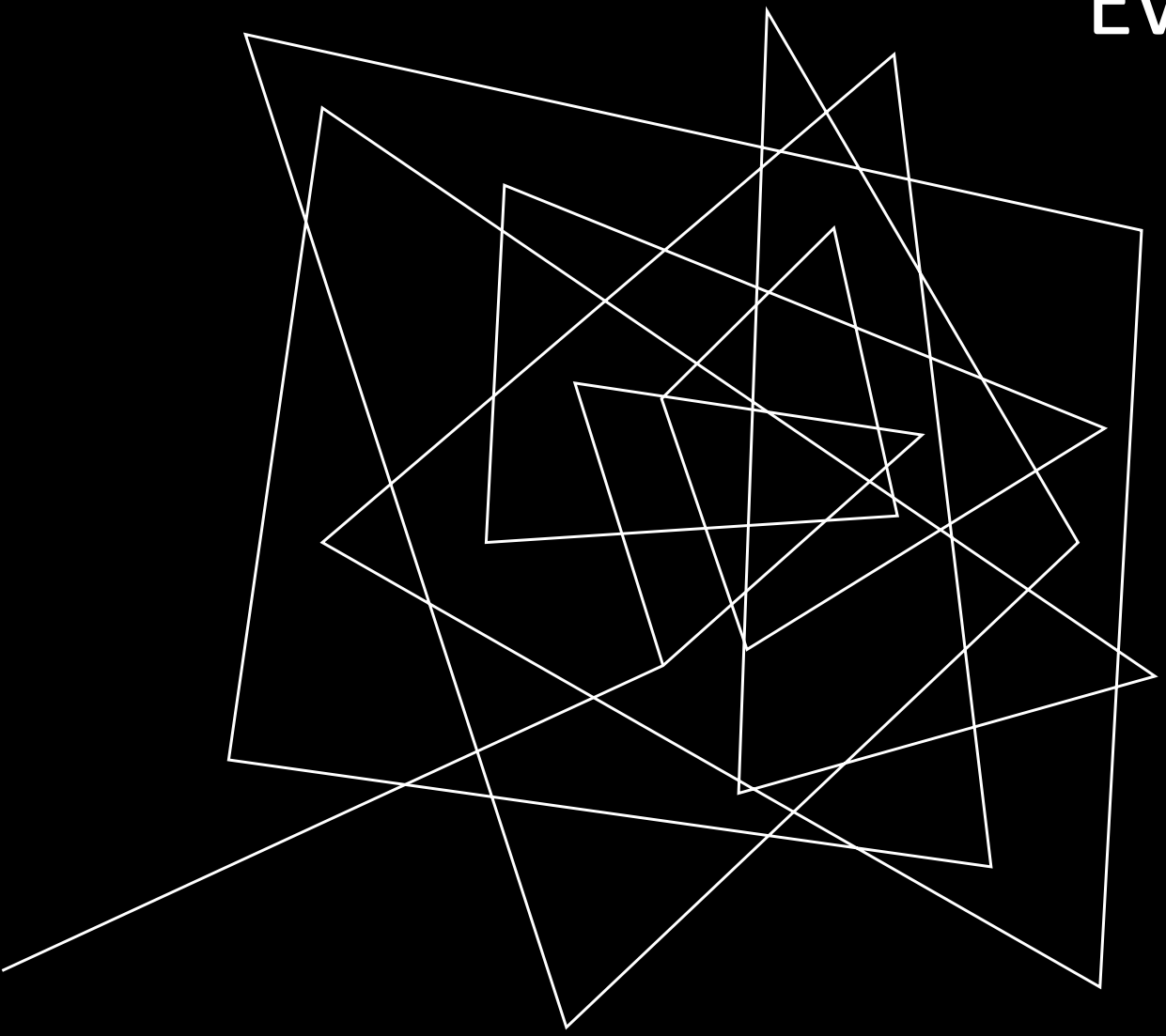


Bergmans RS, Clauw DJ, Flint C, Harris H, Lederman S, Schrepf A. *Chronic overlapping pain conditions increase the risk of long COVID features, regardless of acute COVID status*. PAIN. 2024; 165(5):1112-1120.

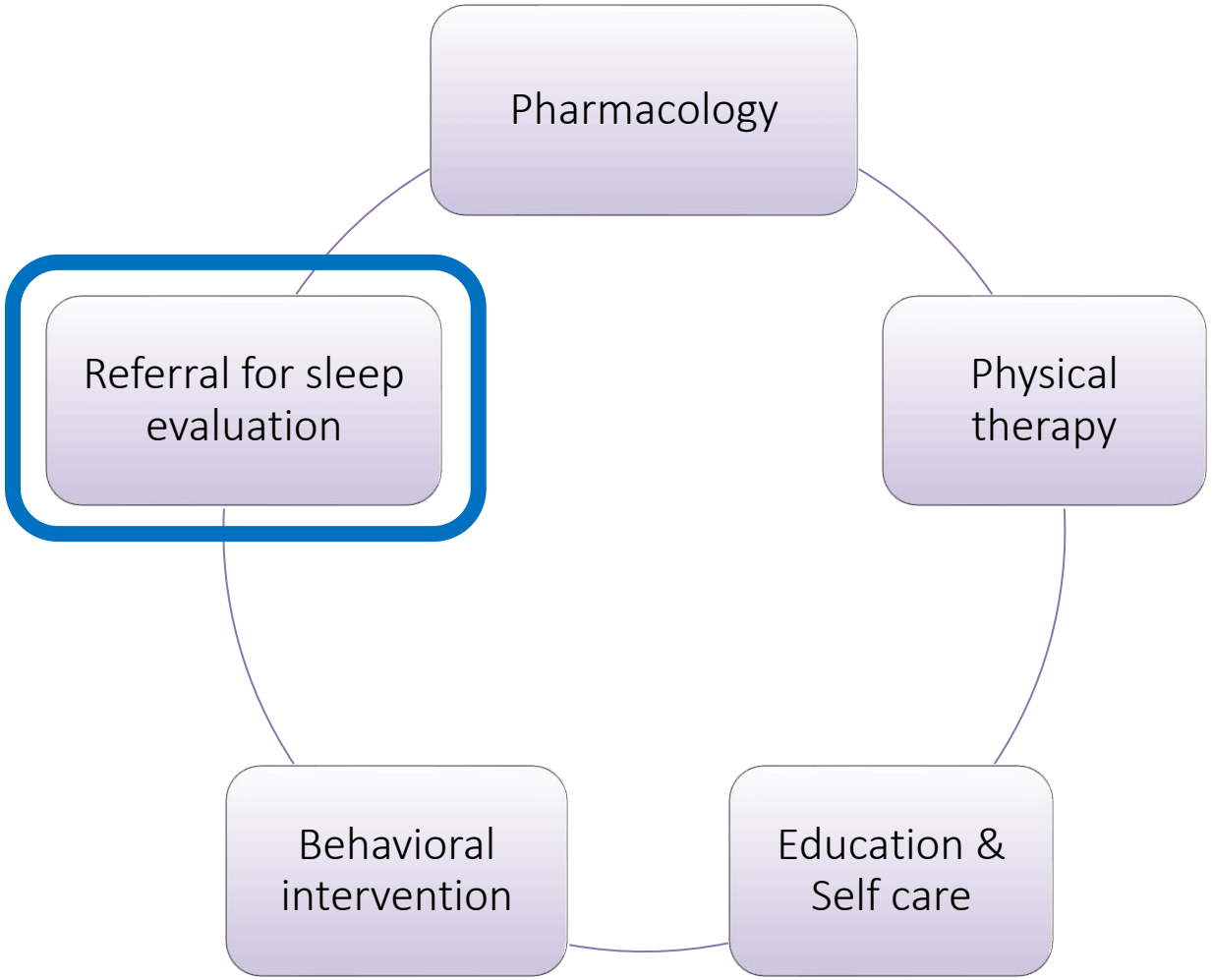
Fitzcharles MA, Cohen SP, Häuser W. *A step towards better understanding chronic overlapping pain conditions*. PAIN. 2024; 165(5):970-971.

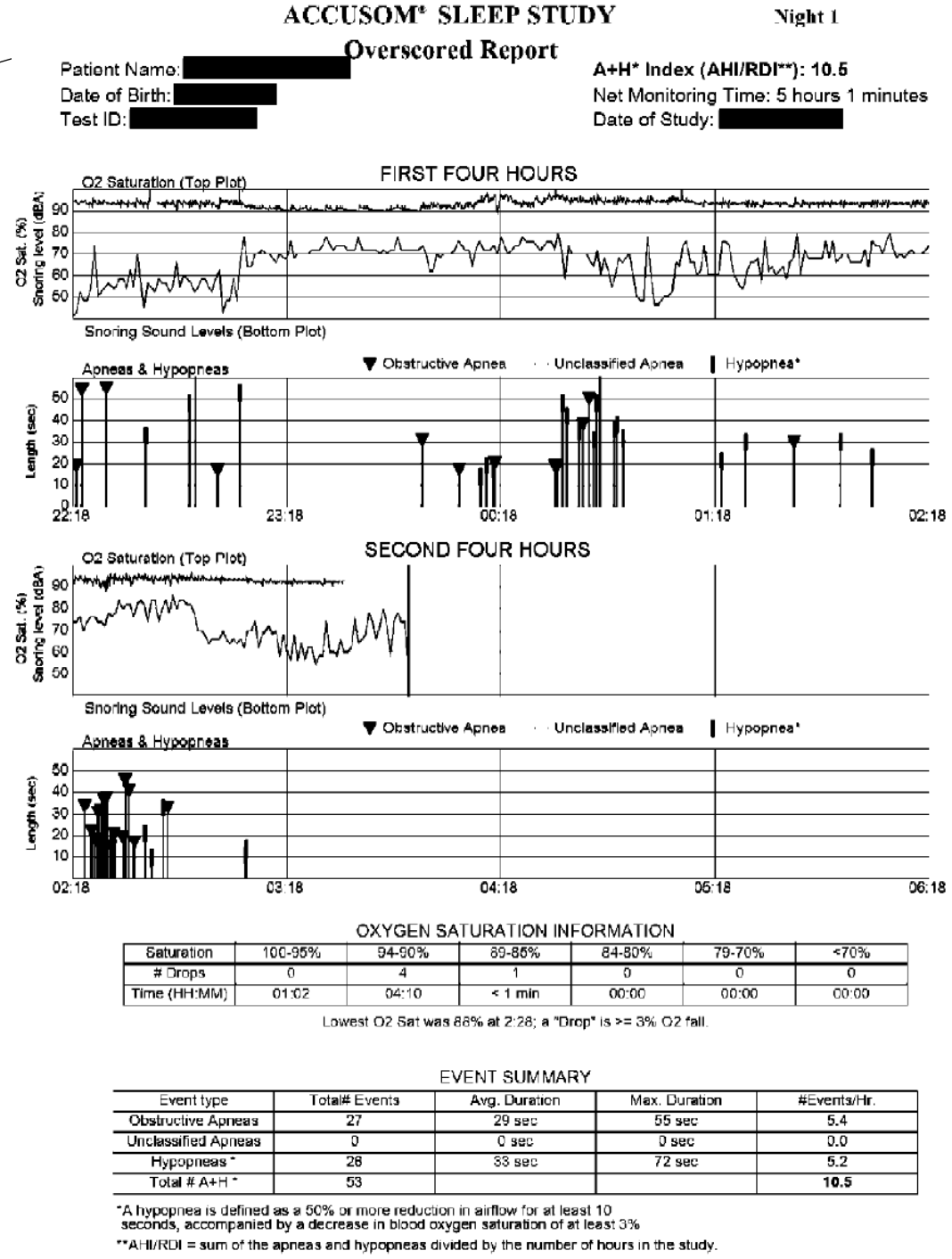
Zorina-Lichtenwalter K, Bango CI, Van Oudenhove L, Čeko M, Lindquist MA, Grotzinger AD, Keller MC, Friedman NP, Wager TD. *Genetic risk shared across 24 chronic pain conditions: identification and characterization with genomic structural equation modeling*. PAIN. 2023; 164(10):2239-2252.

Evidence-based treatments for Ms. P?



What OFP would do for Ms. P:





ACCUSOM® SLEEP STUDY Night 1

Overscored Report

Patient Name: [redacted]
Date of Birth: [redacted]
Test ID: [redacted]

A+H* Index (AHI/RDI**): 10.5
Net Monitoring Time: 5 hours 1 minutes
Date of Study: [redacted]

OXYGEN SATURATION INFORMATION

Saturation	100-95%	94-90%	89-85%	84-80%	79-70%	<70%
# Drops	0	4	1	0	0	0
Time (HH:MM)	01:02	04:10	< 1 min	00:00	00:00	00:00

Lowest O2 Sat was 86% at 2:28; a "Drop" is >= 3% O2 fall.

EVENT SUMMARY

Event type	Total# Events	Avg. Duration	Max. Duration	#Events/Hr.
Obstructive Apneas	27	29 sec	55 sec	5.4
Unclassified Apneas	0	0 sec	0 sec	0.0
Hypopneas *	26	33 sec	72 sec	5.2
Total # A+H *	53			**10.5**

*A hypopnea is defined as a 50% or more reduction in airflow for at least 10 seconds, accompanied by a decrease in blood oxygen saturation of at least 3%

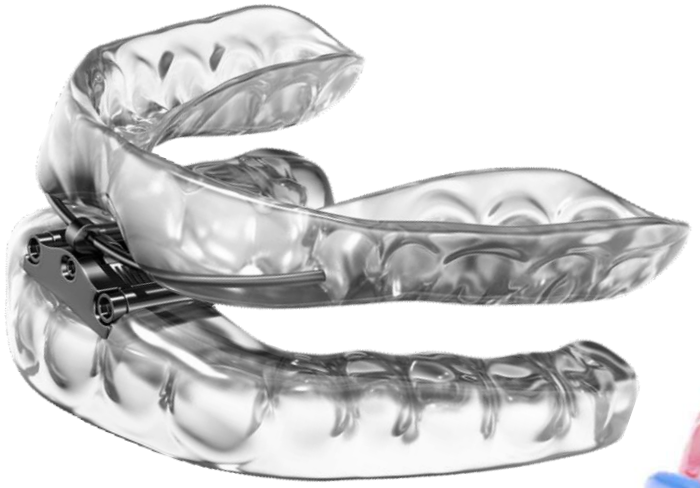
**AHI/RDI = sum of the apneas and hypopneas divided by the number of hours in the study.

HST:

- AHI/RDI *3%*: 10.5
- AHI/RDI *4%*: 6.2
- Nadir: 88%
- CT 90%: 0%

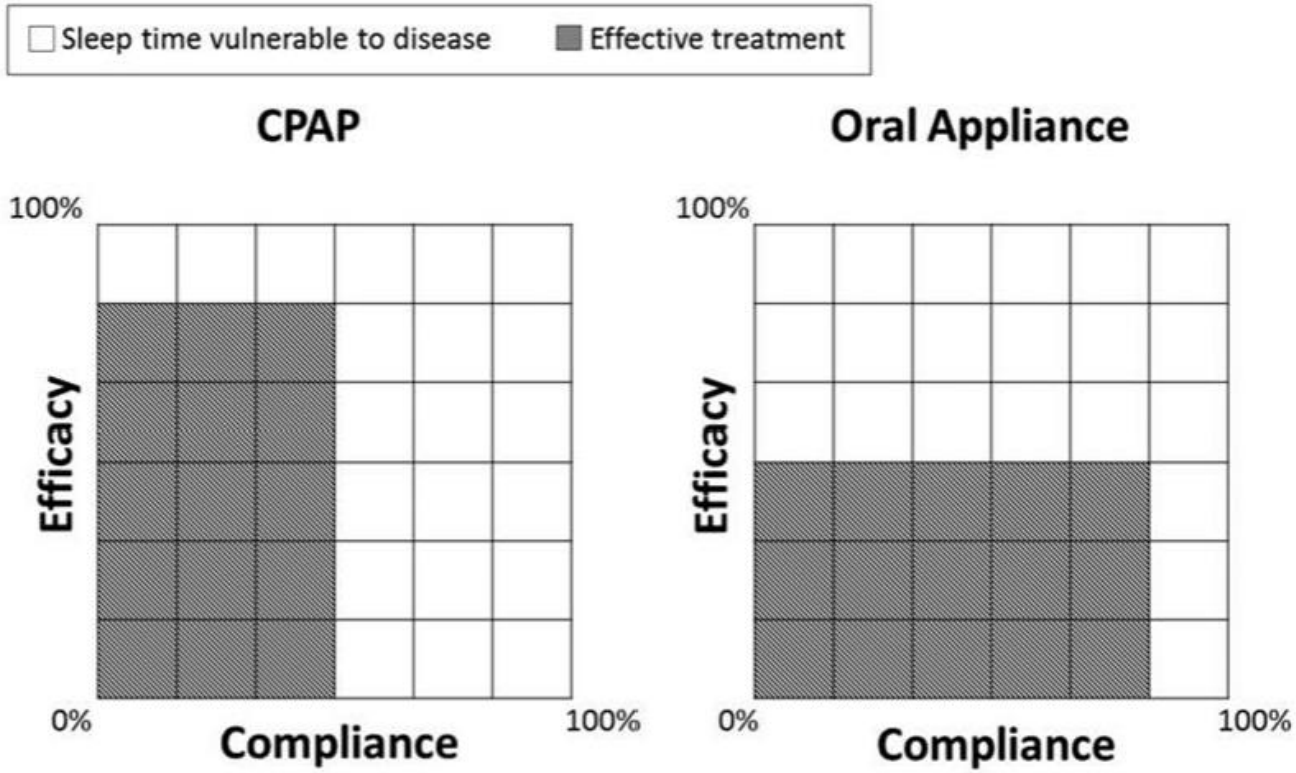
- Snoring:
  - mean 68 dBa
  - Max 86 dBa
  - 99% of time was above 50 dBa

Oral Appliance Therapy (OAT)



Sangalli L, Yanez-Regonesi F, Fernandez-Vial D, Martinez-Porras A, Moreno-Hay I. *Comparison of three mandibular advancement device designs in the management of obstructive sleep apnea: a retrospective study*. J Dent Sleep Med. 2021; 9(3).
Yu M, Ma Y, Han F, Gao X. *Long-term efficacy of mandibular advancement devices in the treatment of adult obstructive sleep apnea: A systematic review and meta-analysis*. Plos one. 2023; 18(11):e0292832.

OAT vs CPAP effectiveness…



Efficacy (y axis) reflects the ability of treatment to prevent obstructive breathing events when it is physically applied. Compliance (x axis) reflects the hours the treatment is applied for over the total sleep time when obstructive events can occur. "Effectiveness" requires both efficacy and compliance and the balance of these likely reflects over health outcomes. This schematic illustrates the scenario of an oral appliance which is only half as efficacious as CPAP but has two-fold greater compliance which results in equivalent effectiveness (shaded area).

Sutherland K, Phillips CL, Cistulli PA. *Efficacy versus effectiveness in the treatment of obstructive sleep apnea: CPAP and oral appliances*. J Dent Sleep Med. 2015; 2(4):175-81.

Does OAT cause TMD?

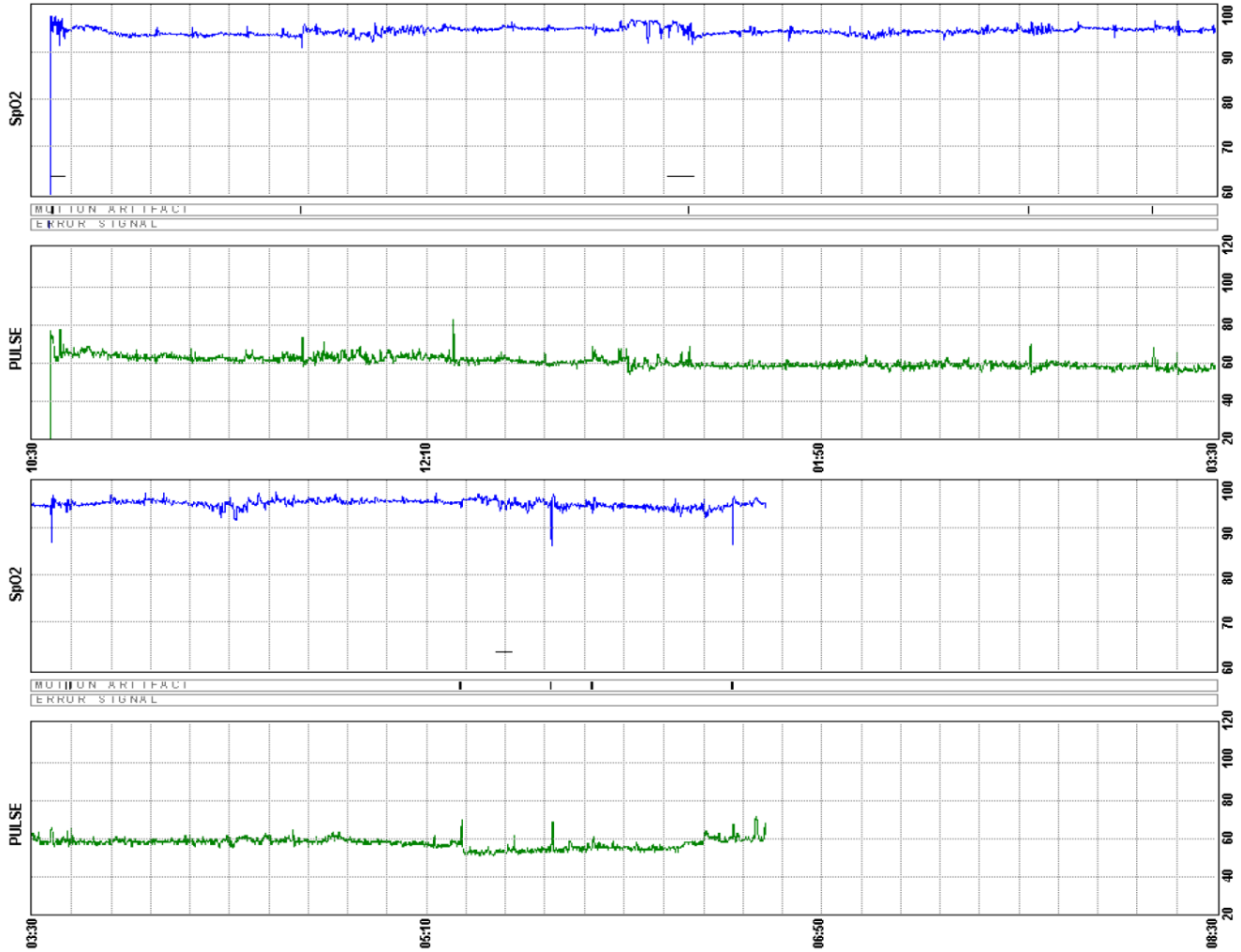
- n=103 RCT, CPAP vs OAT, follow up @2mo, 1y, 2y
- Only @2mo: painful TMD symptoms higher in OAT (24%) than in CPAP (6%)
- Generally mild and transient AEs, not a contraindication

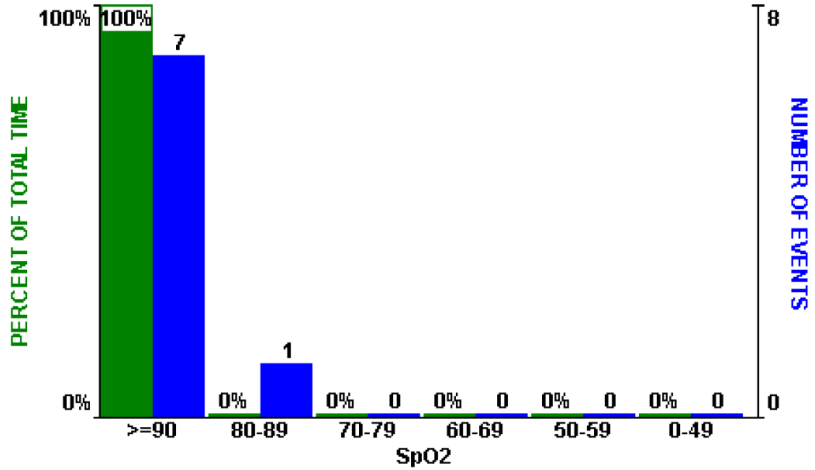
Doff MH, Veldhuis SK, Hoekema A, Slater JJ, Wijkstra PJ, de Bont LG, Stegenga B. *Long-term oral appliance therapy in obstructive sleep apnea syndrome: a controlled study on temporomandibular side effects*. Clinical Oral Investigations. 2012; 16:689-97.

- n=29 RCT, jaw exercises vs sham
- Exercises group showed significant improvement in their sleep quality, QoL, reduction of pain, higher compliance vs sham ($p<0.05$)
- Sham group had higher number of patients with persistent pain ($p=0.01$)

Cunali PA, Almeida FR, Santos CD, Valdrichi NY, Nascimento LS, Dal-Fabbro C, Tufik S, Bittencourt LR. *Mandibular exercises improve mandibular advancement device therapy for obstructive sleep apnea*. Sleep and Breathing. 2011; 15:717-27.

Ms. P follow-up pulseOx





- RDI/ODI4: 1
- Nadir: 88%
- Mean SpO2: 94%
- CT <90%: 0%
- Snoring abolished per bed partner report

Sleep  TMD

- n=2,604 prospective cohort; 248 individuals developed first-onset TMD during median 2.8-year follow-up
- High risk of OSA associated with greater incidence of first-onset TMD (HR 1.73, 95% CI 1.14–2 .62)
- n=1,716 case-control
- High risk of OSA associated with higher odds of chronic TMD (OR 3.63, 95% CI 2.03–6.52)

Sanders AE, Essick GK, Fillingim R, Knott C, Ohrbach R, Greenspan JD, Diatchenko L, Maixner W, Dubner R, Bair E, Miller VE. *Sleep apnea symptoms and risk of temporomandibular disorder: OPPERA cohort*. Journal of Dental Research. 2013; 92(7_suppl):S70-7.

- n=4,105 OSA patients; n=41,050 controls
- population-based cohort, Taiwan health database
- TMD incidence rate significantly higher in OSA (HR 2.5, 95% CI 1.7–3.7, *p<0.0001*)

Wu JH, Lee KT, Kuo CY, Cheng CH, Chiu JY, Hung JY, Hsu CY, Tsai MJ. *The association between temporomandibular disorder and sleep apnea—A nationwide population-based cohort study*. International Journal of Environmental Research and Public Health. 2020; 17(17):6311.

- Meta analysis: positive association with OSA was found in patients with TMD (OR 2.61, 95% CI 2.31–2.95)

Machado CA, de Resende CM, Stuginski-Barbosa J, Porporatti AL, Carra MC, Michelloti A, Boucher Y, Simamoto Junior PC. *Association between obstructive sleep apnea and temporomandibular disorders: A meta-analysis*. Journal of Oral Rehabilitation. 2024; 51(10):2220-33.

- SNPs extracted from pooled GWAS datasets from Finnish Biobank
  - 19 SNPs for OSA: n=375,657 (38,998 cases; 336,659 controls)
  - 13 SNPs for TMD: n=181,934 (4,273 cases; 177,661 controls)
- Bidirectional Mendelian randomization
- OSA had a significant causal influence on TMD (OR 1.241, 95% CI 1.009–1.526, *p=0.041)*
- TMD had no significant causal effect on OSA (OR 0.975, 95% CI 0.918–1.036, *p=0.411*)

Wang YP, Wei HX, Hu YY, Niu YM. *Causal Relationship Between Obstructive Sleep Apnea and Temporomandibular Disorders: A Bidirectional Mendelian Randomization Analysis*. Nature and Science of Sleep. 2024; 16:1045-52.

What about bruxism?

- Morning pain doesn't correlate with higher frequency of jaw muscle contractions related to sleep bruxism

  Abe S, Carra MC, Huynh NT, Rompré PH, Lavigne GJ. *Females with sleep bruxism show lower theta and alpha electroencephalographic activity irrespective of transient morning masticatory muscle pain*. J Orofac Pain. 2013; 27(2):123–134.

  Yachida W, Castrillon EE, Baad-Hansen L, Jensen R, Arima T, Tomonaga A, Ohata N, Svensson P. *Craniofacial pain and jaw-muscle activity during sleep*. J Dent Res. 2012; 91(6):562–567.

- N=124 women with myofascial TMD, n=46 control participants
- Self-reported rates of sleep bruxism (SB) were significantly higher in case (55.3%) vs control (15.%)
- 2-night PSG-based measures of rhythmic masticatory muscle activity (RMMA) episodes showed much lower and statistically similar rates of SB in case (9.7%) vs control (10.9%)

  Raphael KG, Sirois DA, Janal MN, Wigren PE, Dubrovsky B, Nemelivsky LV, Klausner JJ, Krieger AC, Lavigne GJ. *Sleep bruxism and myofascial temporomandibular disorders: A laboratory-based polysomnographic investigation*. J Am Dent Assoc. 2012; 143(11):1223–1231.

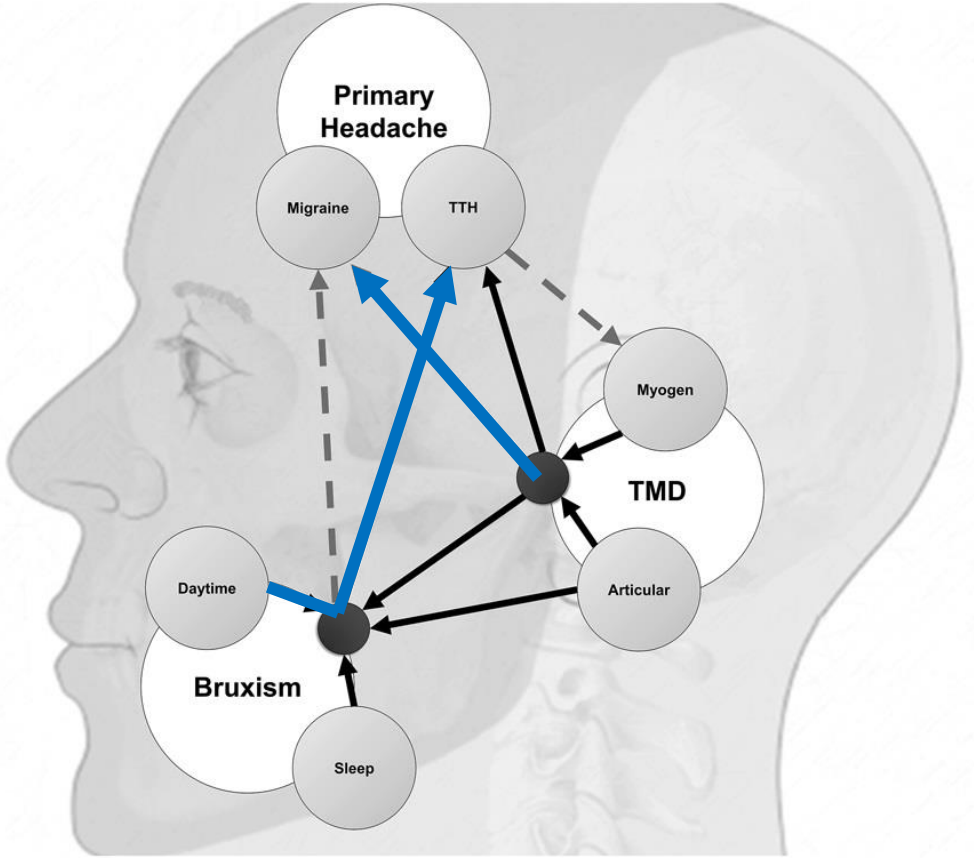
- TMD-related pain is not related to the intensity of sleep bruxism

  Smardz J, Martynowicz H, Michalek-Zrabkowska M, Wojakowska A, Mazur G, Winocur E, Wieckiewicz M. *Sleep bruxism and occurrence of temporomandibular disorders-related pain: a polysomnographic study*. Frontiers in Neurology. 2019;10:168.

What about bruxism?

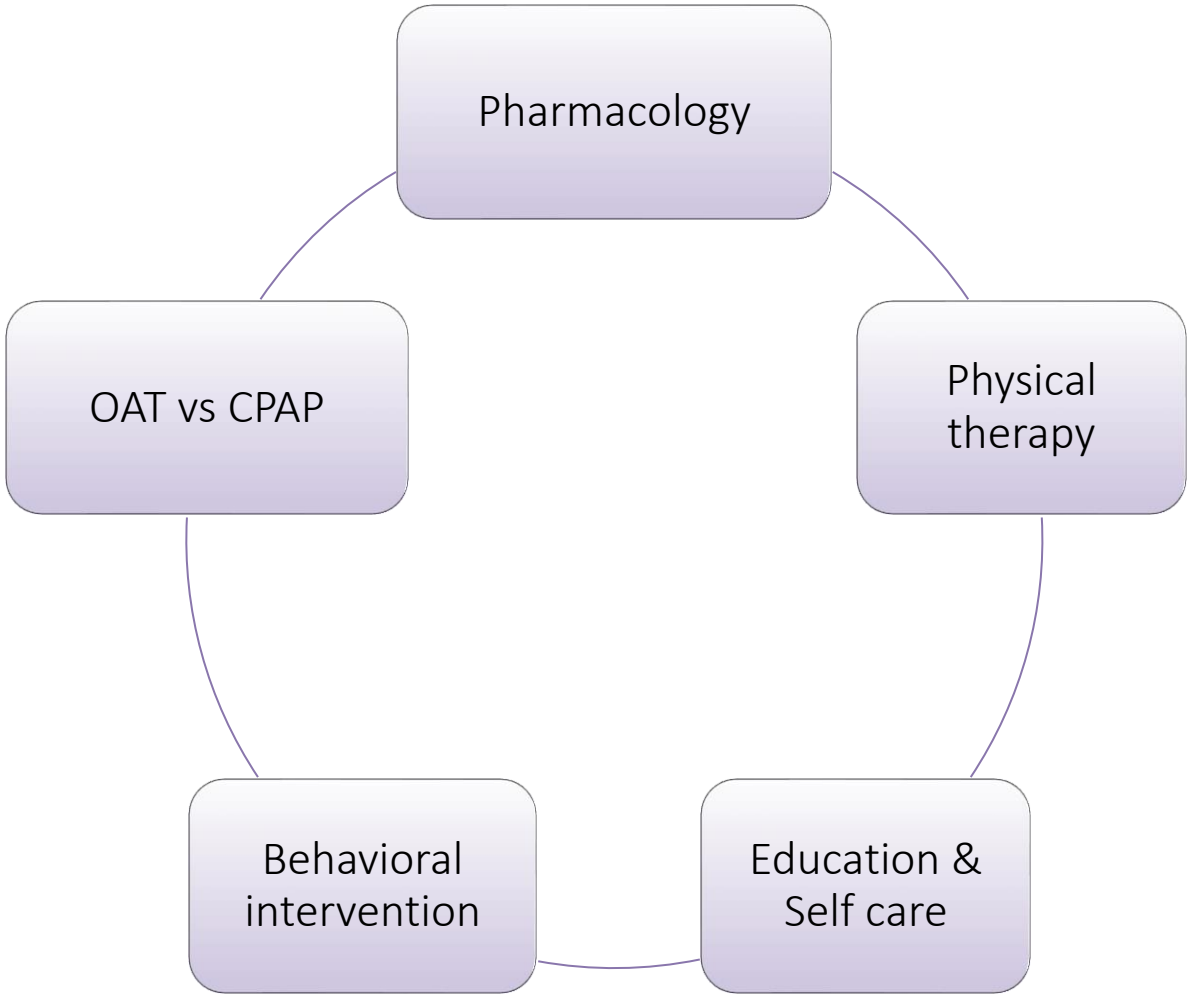
- Bruxism is a behavior, not a pain syndrome
  - Sleep bruxism (SB) vs Awake bruxism (AB)
- Self-report tends to overestimate SB (12.5% questionnaire vs 7.4% on PSG)
- Bruxism on PSG shows individuals with more EMG activity are ***less*** likely to have TMD pain
- Painful TMD leads to a reduction of SB (pain has an inhibitory effect on jaw muscle activity)

Correlation	No correlation
AB → tension-type headache TMD → migraine	TMD → tension-type headaches SB → primary headaches SB → TMD



Voß LC, Basedau H, Svensson P, May A. Bruxism, temporomandibular disorders, and headache—a narrative review of correlations and causalities. Pain. 2024; 165:2409-2418.

What OFP would do for Ms. P:



What OFP would do for Ms. P:

Pharmacology

- NSAIDs
- Muscle relaxants
- Compounded topicals
- SNRI/TCAs
- CGRPs
- BTX to masseters

Busse JW, Casassus R, Carrasco-Labra A, Durham J, Mock D, Zakrzewska JM, Palmer C, Samer CF, Coen M, Guevremont B, Hoppe T, Guyatt GH, Crandon HN, Yao L, Sadeghirad B, Vandvik PO, Siemieniuk RAC, Lytvyn L, Hunskaar BS, Agoritsas T. *Management of chronic pain associated with temporomandibular disorders: a clinical practice guideline*. BMJ. 2023; 383:e076227.

Huff KD, Benoliel R. *Clinical Handbook for Oral, Facial, and Head Pain*. Journal of Oral & Facial Pain and Headache. 2023; 37(4):219-268.

Klasser GD; Reyes MR; eds. *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management*, 7th Ed. Quintessence; 2023.

Romero-Reyes M, Arman S, Teruel A, Kumar S, Hawkins J, Akerman S. *Pharmacological management of orofacial pain*. Drugs. 2023; 83(14):1269-92.

Yao L, Sadeghirad B, Li M, Li J, Wang Q, Crandon HN, Martin G, Morgan R, Florez ID, Hunskaar BS, Wells J. *Management of chronic pain secondary to temporomandibular disorders: a systematic review and network meta-analysis of randomised trials*. BMJ. 2023; 383:e076226.

What OFP would do for Ms. P:

Physical therapy

- Trigger point injections
- GON/SPG blocks

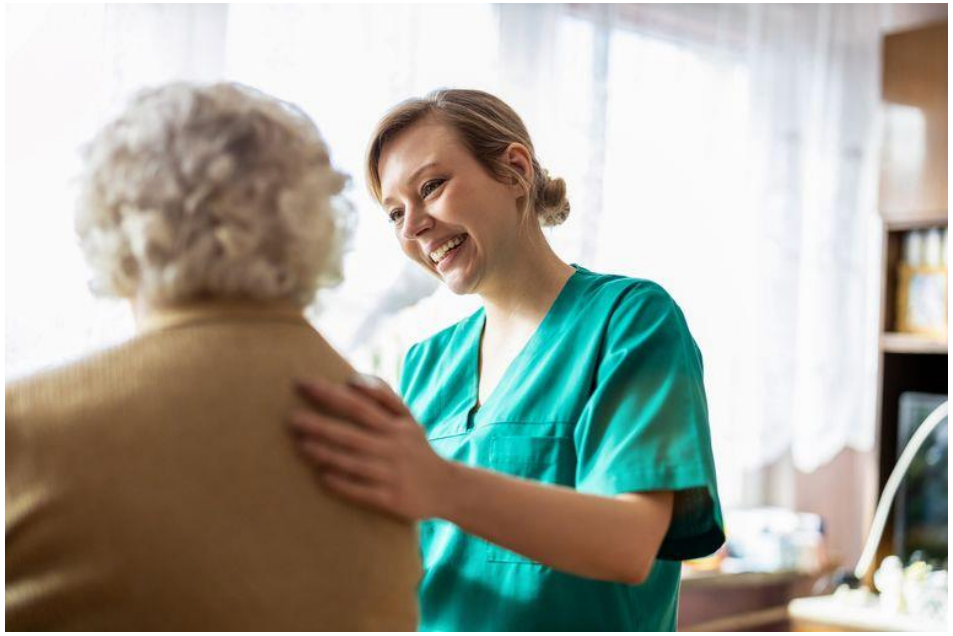
- Myofascial release
- Massage, muscle conditioning
- Home exercise program
- Dry needling
- TMJ mobilization, manipulation
- Heat
- E-stim, ultrasound
- Posture training

Fisch G, Finke A, Ragonese J, Dugas L, Wrzosek M. *Outcomes of physical therapy in patients with temporomandibular disorder: a retrospective review*. British Journal of Oral and Maxillofacial Surgery. 2021; 59(2):145-50.

Prodoehl J, Kahnert E. *Physical therapy for temporomandibular disorders: Evidence-based improvements and enhancements for diagnosis and management*. Frontiers of Oral and Maxillofacial Medicine. 2022; 4:16.

Romeo A, Incorvati C, Vanti C, Turolla A, Marinelli F, Defila L, Gulotta C, Marchetti C, Pillastrini P. *Physical therapy in addition to occlusal splint in myogenic temporomandibular disorders: A randomised controlled trial*. Journal of Oral Rehabilitation. 2024; 51: 1566-1578.

What OFP would do for Ms. P:



Education & Self care

- Patient education
- Habit awareness and reduction
- Modification of function
- Rest and limitations (diet, movements)
- Home physiotherapy
- Heat/cold
- Exercises
- Distraction
- Sleep and lifestyle changes

Lindfors E, Magnusson T, Ernberg M. *Effect of Therapeutic Jaw Exercises in the Treatment of Masticatory Myofascial Pain: A Randomized Controlled Study*. Journal of Oral & Facial Pain & Headache. 2020; 34(4):364-373.

Lindfors E, Hedman E, Magnusson T, Ernberg M, Gabre P. *Patient Experiences of Therapeutic Jaw Exercises in the Treatment of Masticatory Myofascial Pain: A Qualitative Study*. Journal of Oral & Facial Pain & Headache. 2017; 31(1).

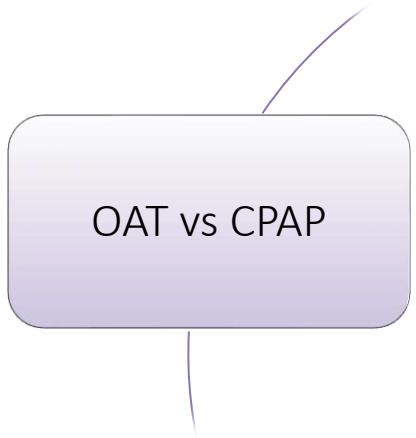
What OFP would do for Ms. P:

Burns JW, Jensen MP, Thorn B, Lillis TA, Carmody J, Newman AK, Keefe F. *Cognitive therapy, mindfulness-based stress reduction, and behavior therapy for the treatment of chronic pain: randomized controlled trial*. PAIN. 2022;163(2):376-89.
Jang HH, Kim ME, Kim HK. *Pain Catastrophizing Mediates the Effects of Psychological Distress on Pain Interference in Patients with Orofacial Pain: A Cross-Sectional Study*. Journal of Oral & Facial Pain & Headache. 2018;32(4):409-417.
Kindler S, et al. *Association Between Symptoms of Posttraumatic Stress Disorder and Signs of Temporomandibular Disorders in the General Population*. Journal of Oral & Facial Pain & Headache. 2019; 33(1):67-76.
Reiter S, et al. *Pain Catastrophizing and Pain Persistence in Temporomandibular Disorder Patients*. Journal of Oral & Facial Pain & Headache. 2018; 32(3):309-320.
Sartori LR, Pereira DH, Baker SR, Correa MB. *Association between adverse childhood experiences and oral health in adulthood: a systematic scoping review*. Journal of Family Violence. 2023; 38(8):1607-24.
Yershova K, Lesser A, Logan K, Posner K. *Asking about suicide as suicide prevention: the Columbia suicide severity rating scale (C-SSRS)*. Understanding suicide: From diagnosis to personalized treatment. Springer. 2016:29-41.

Behavioral intervention

- Social history
- Screeners (GCPS, PHQ-9, GAD-7, PHQ-4, C-SSRS)
- Recognize catastrophizing
- ACE scores, trauma-informed care
- Referral for behavioral health (CBT, CBTi, ACT, biofeedback, MBSR, EMDR, PainTrainer.org)

What OFP would do for Ms. P:



- CPAP: reinforce compliance
- OAT: referral back to Rx'ing physician for confirmation of efficacy
- Reinforce good sleep hygiene
  - Consistent sleep schedule with a relaxing bedtime routine
  - If still awake after 20 minutes, *get out of bed*. Do quiet activities in dim light exposure. No electronics!
  - Bed is only for sleep and sex
  - Keep your bedroom quiet, relaxing, comfortable, and cool
  - Turn off electronics at least 30 minutes before bedtime
  - Avoid caffeine after 2pm
  - Avoid consuming alcohol before bedtime

Healthy Sleep Habits, Sleep Education. American Academy of Sleep Medicine; 2020. Retrieved from https://sleepeducation.org/healthy-sleep/healthy-sleep-habits/

Runge N, Ahmed I, Saueressig T, Perea J, Labie C, Mairesse O, Nijs J, Malfliet A, Verschueren S, Van Assche D, de Vlam K. *The bidirectional relationship between sleep problems and chronic musculoskeletal pain: a systematic review with meta-analysis*. Pain. 2024; 165(11):2455-67.

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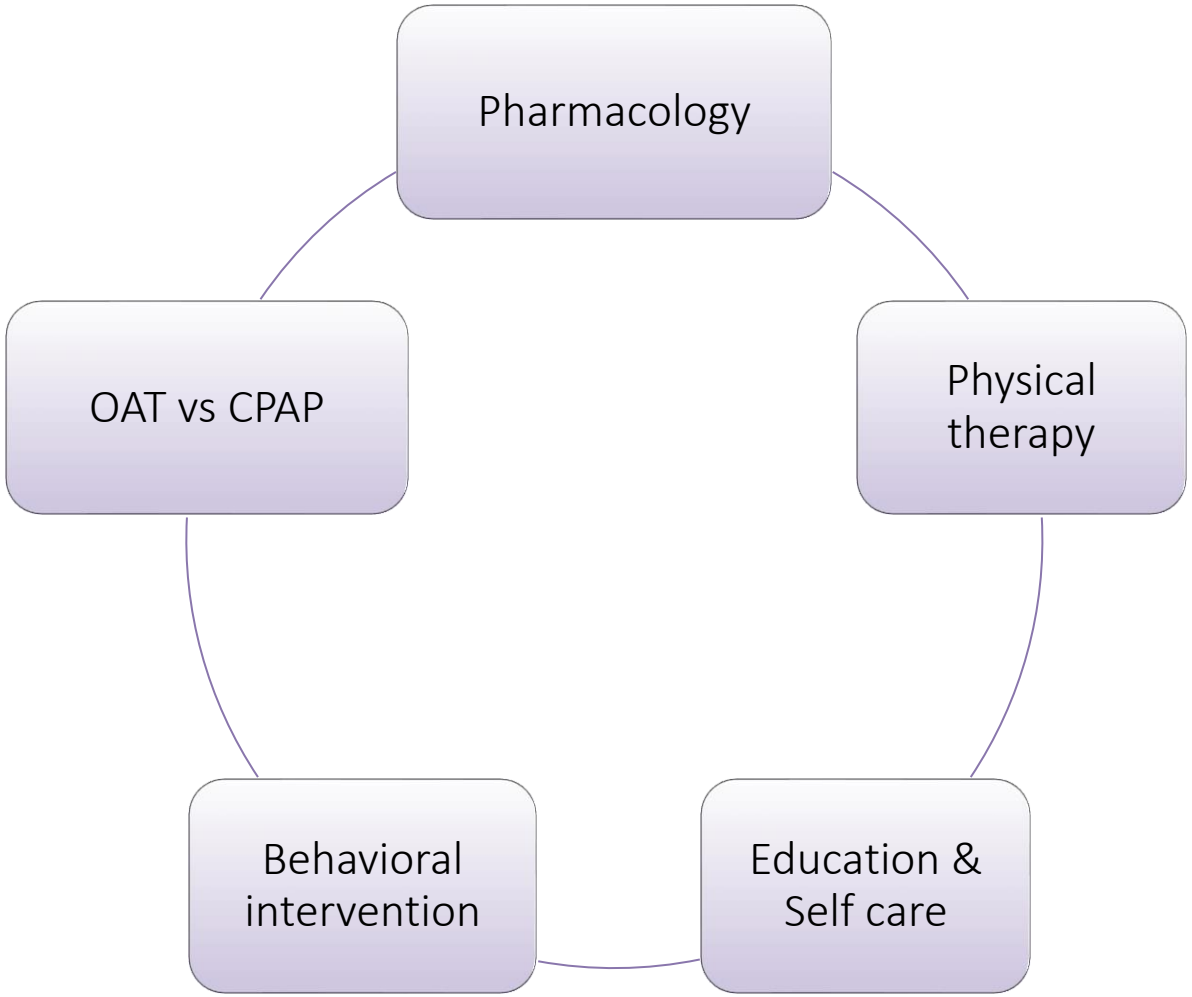
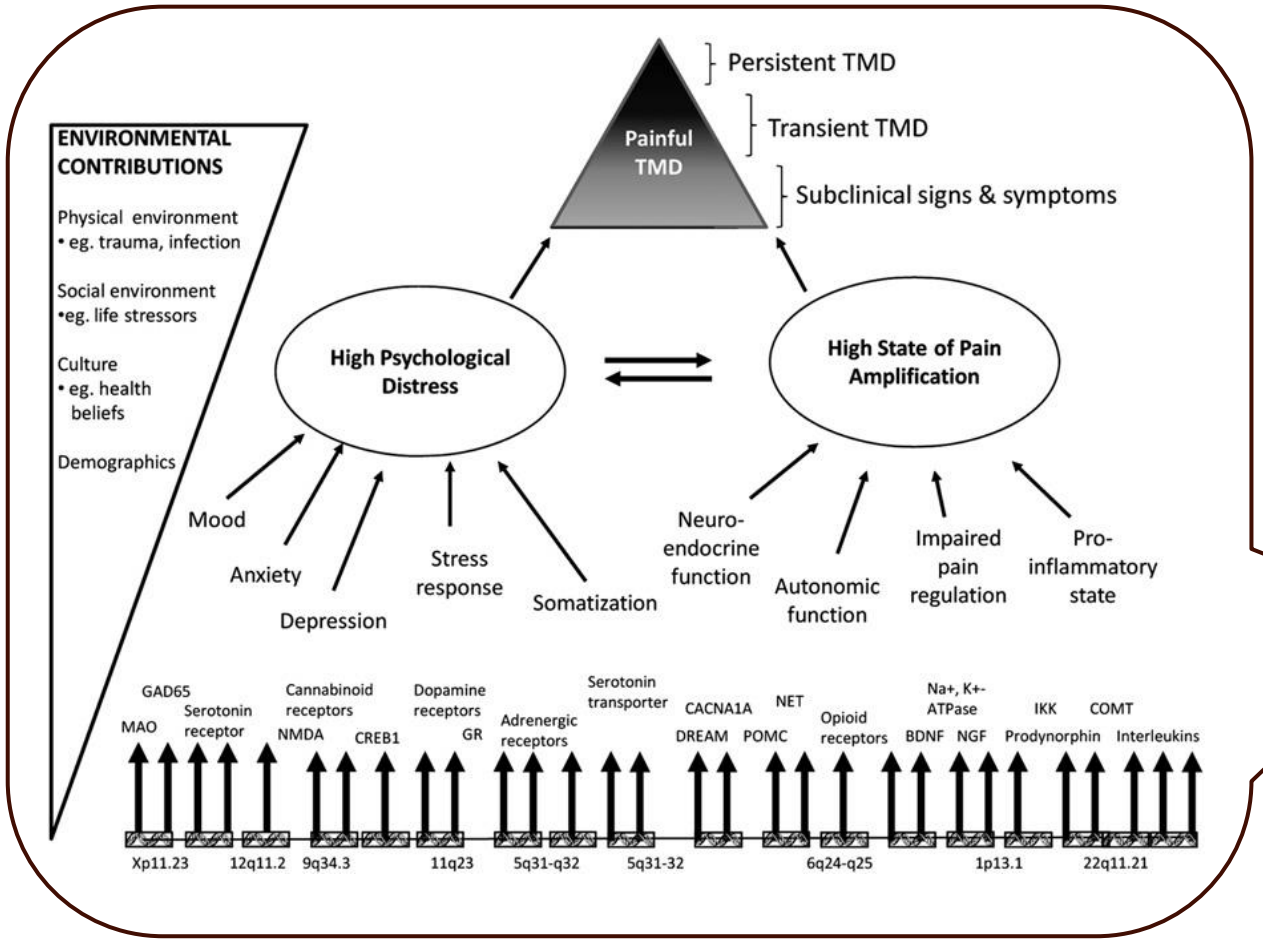
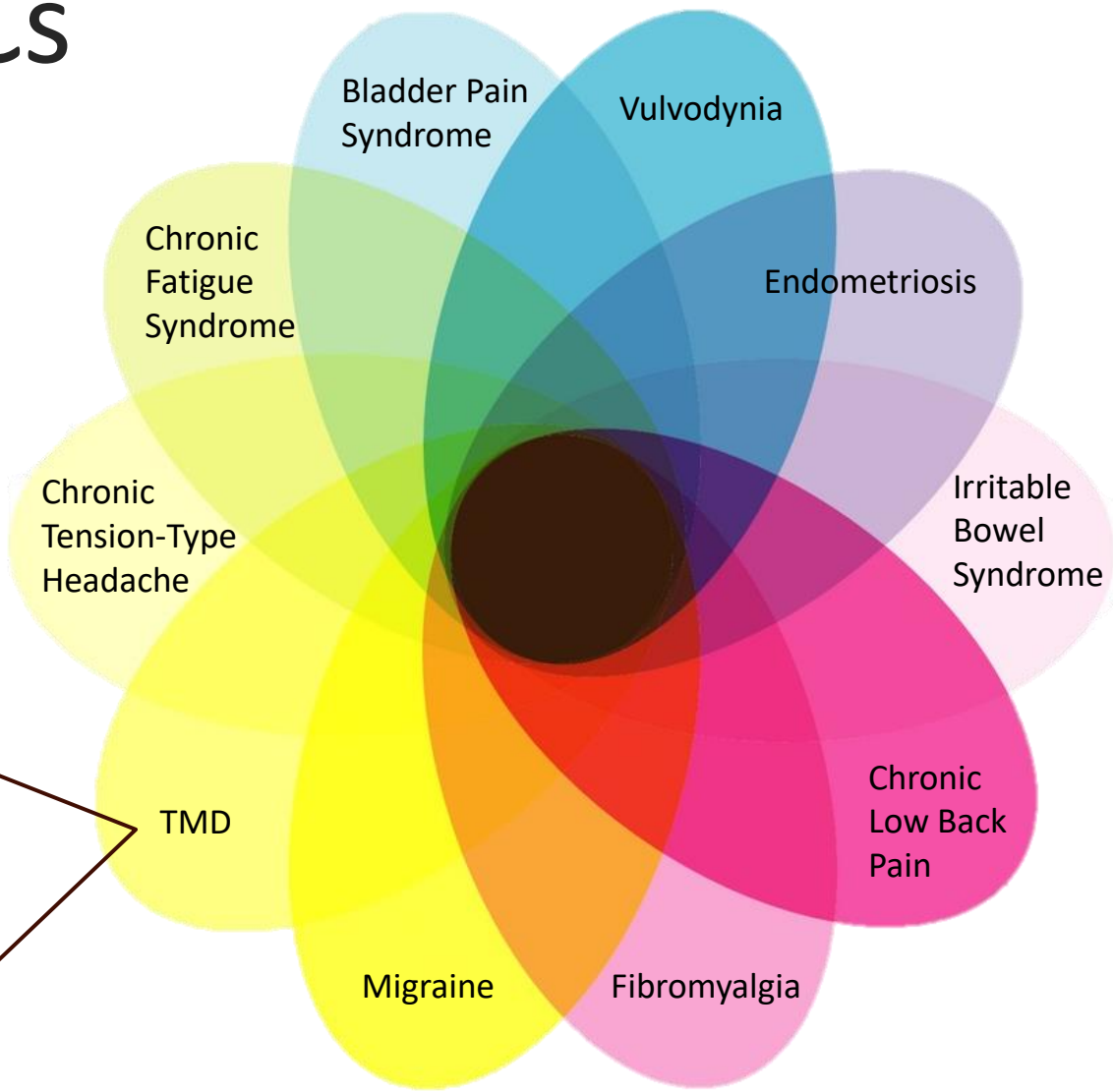


Nociplastic pain of COPCs

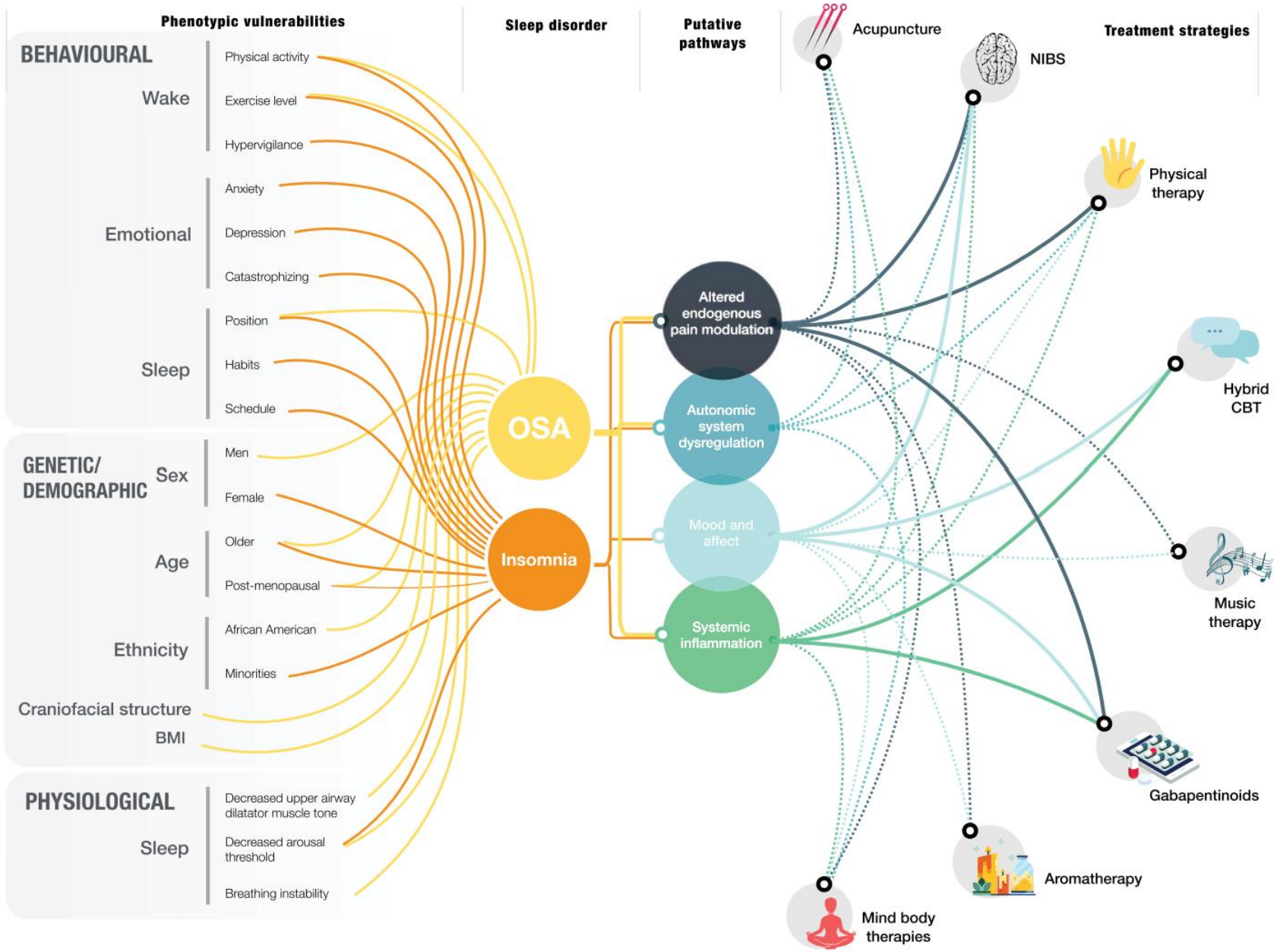




Maixner W, Diatchenko L, Dubner R, Fillingim RB, Greenspan JD, Knott C, Ohrbach R, Weir B, Slade GD. *Orofacial Pain Prospective Evaluation and Risk Assessment Study – The OPPERA Study*. J Pain 2011; 12(11, Supplement):T4-T11.e12.

Fitzcharles MA, Cohen SP, Häuser W. *A step towards better understanding chronic overlapping pain conditions*. PAIN. 2024; 165(5):970-971.

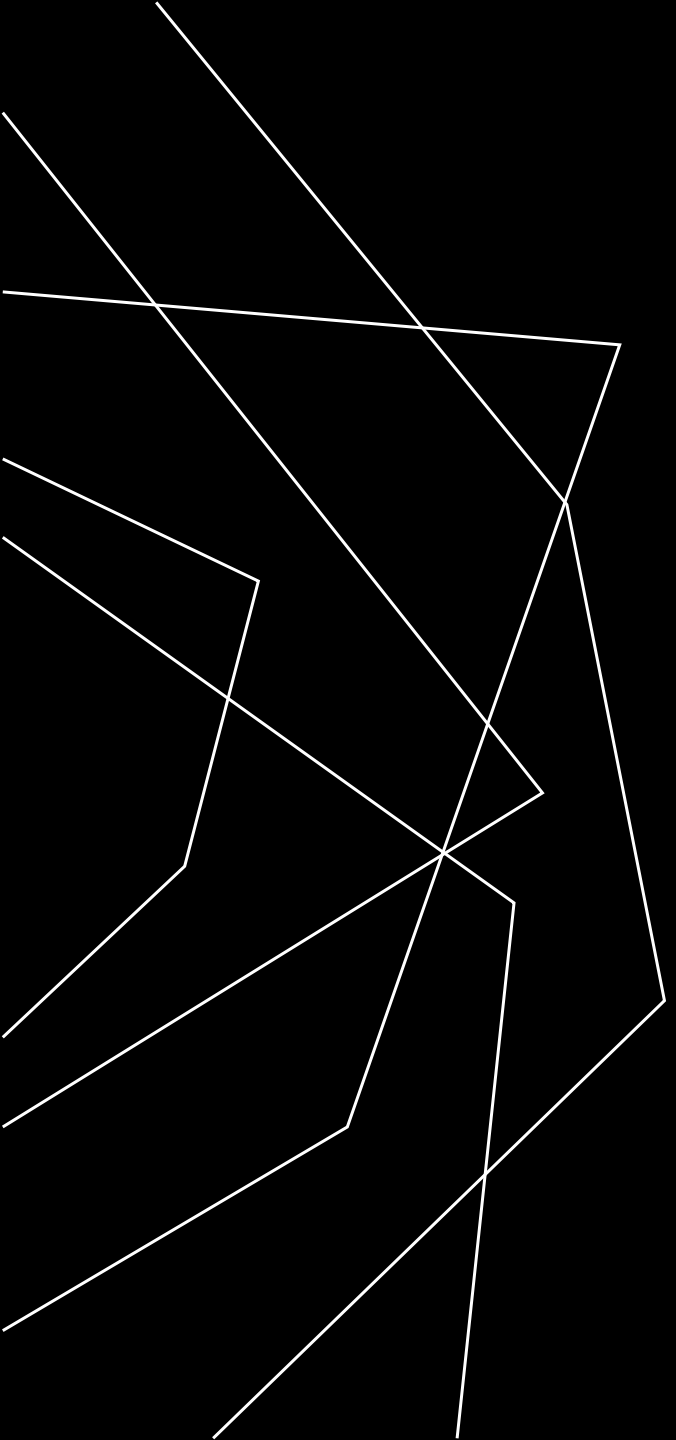
Phenotypic variables of insomnia & OSA in individuals with chronic pain



Babiloni AH, Beetz G, Tang NK, Heinzer R, Nijs J, Martel MO, Lavigne GJ. *Towards the endotyping of the sleep–pain interaction: a topical review on multitarget strategies based on phenotypic vulnerabilities and putative pathways*. Pain. 2021; 162(5):1281-8.

The future of Sleep & Pain?

Babiloni AH, Beetz G, Tang NK, Heinzer R, Nijs J, Martel MO, Lavigne GJ. *Towards the endotyping of the sleep–pain interaction: a topical review on multitarget strategies based on phenotypic vulnerabilities and putative pathways*. Pain. 2021; 162(5):1281-8.



THANK YOU!

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Clarksville, MD
office 443-535-9600
cell 410-746-4543