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Why do we need to care about bruxism ?

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Sapporo, September 29, 2013

Agenda today

1. What is bruxism?
2. Why do we brux ?
3. How can we assess bruxism?
4. What can bruxism cause?
5. How can we manage bruxism?

Disclosure

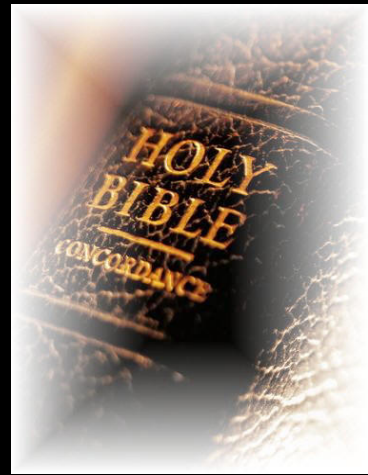


- Chairman Clinical Advisory Board for Medotech A/S 2008-2012

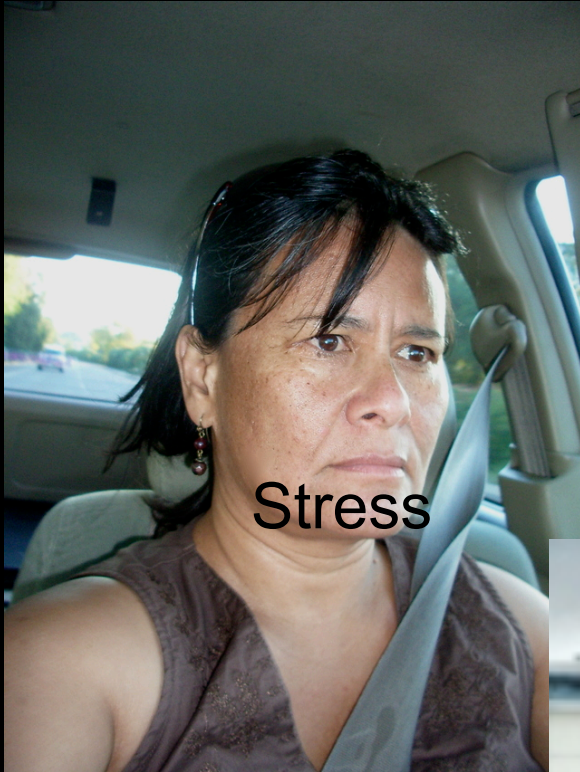


1. What is bruxism ?

- “Like profane mockers at a feast, they *gnash* at me with their teeth” (Psalm 35:16)
- “The sinner shall see and be angry, he shall *gnash* his teeth and consume away” (Psalm 112:10)
- “He *grinds* his teeth at me” (Job 16:9)
- “But the children of the kingdom shall be cast out into outer darkness: there shall be weeping and *gnashing* of teeth” (Matthew 8:12)



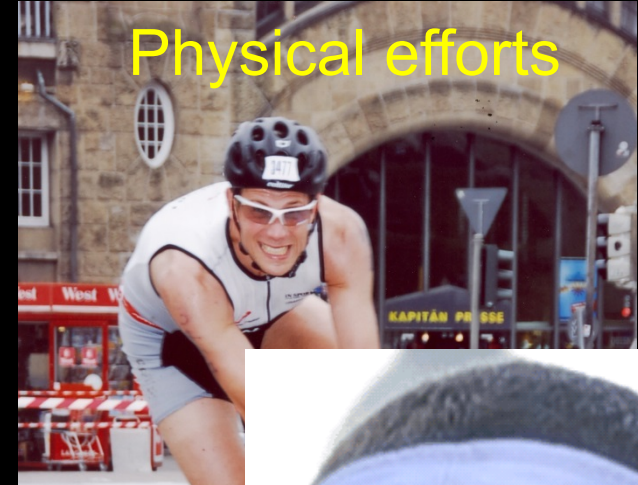
Tooth grinding - clenching



Stress



Aggression



Physical efforts



Emotions



Old classical concept

”A gnashing and grinding of the teeth for non-functional purposes”



Ramfjord & Ash 1971

Glossary of Prosthodontic Terms

- The *parafunctional* grinding of the teeth, and as an *oral habit* consisting of *involuntary* rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of the teeth, in other than chewing movements of the mandible, which may lead to *occlusal trauma*.

International Classification of Sleep Disorders

- Sleep-related *movement disorder* - oral activity characterized by grinding or clenching of the teeth during *sleep*, usually associated with sleep *arousals*.

Orofacial Pain Guidelines

- *Diurnal or nocturnal parafunctional activity* including clenching, bracing, gnashing, and grinding of the teeth.

**All definitions have some limitations....
Time for something new !**

Proposed new definition

- *Bruxism is a repetitive jaw-muscle activity that is characterized by clenching or grinding of the teeth and / or by bracing or thrusting of the mandible*
- *Bruxism has two distinct circadian manifestations: it can occur during sleep (sleep bruxism) or during wakefulness (awake bruxism)*

Diagnostic grading of bruxism

- Possible
 - History / questionnaire
- Probable
 - History / questionnaire +
 - Clinical examination
- Definite
 - History / questionnaire +
 - Clinical examination +
 - Polysomnographic / EMG examination

Primary bruxism

- Two conditions
 - Awake
 - Sleep
- Three types
 - Tooth-grinding
 - Tooth-clenching
 - Bracing / thrusting



Multiple forms of bruxism?

- Conditions
 - Awake
 - Sleep
- Type
 - Grinding
 - Clenching
 - Bracing / thrusting
- Contraction
 - Concentric
 - Eccentric
- EMG intensity / force
 - Low
 - Medium
 - High
- EMG frequency
 - Episodic
 - Frequent
 - Constant

> 2 x 3 x 2 x 3 x 3 = 108 different types of bruxism

e.g. Awake – clenching – concentric - medium force - frequent

Prevalence

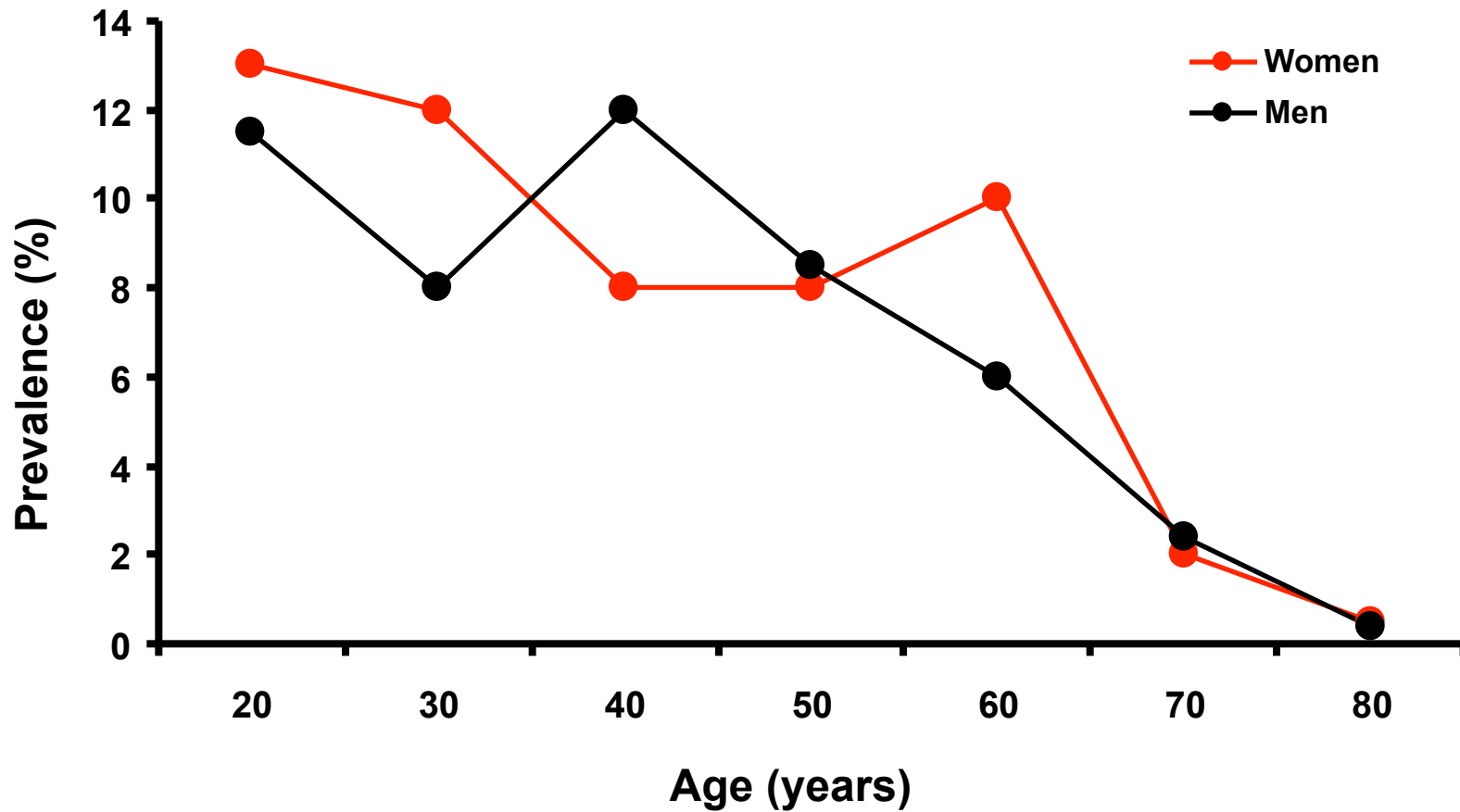
- Awake bruxism
 - Approx. 20%
- Sleep bruxism
 - Approx. 5-8%
 - 14% of children
 - 8% of adults
 - 3% of > 60 years
 - No gender differences

Based on self-reports

Likely under-estimates

Lavigne et al. 2008
Manfredini et al. 2013ab

Self-reports of sleep bruxism



Interview > 2000 participants

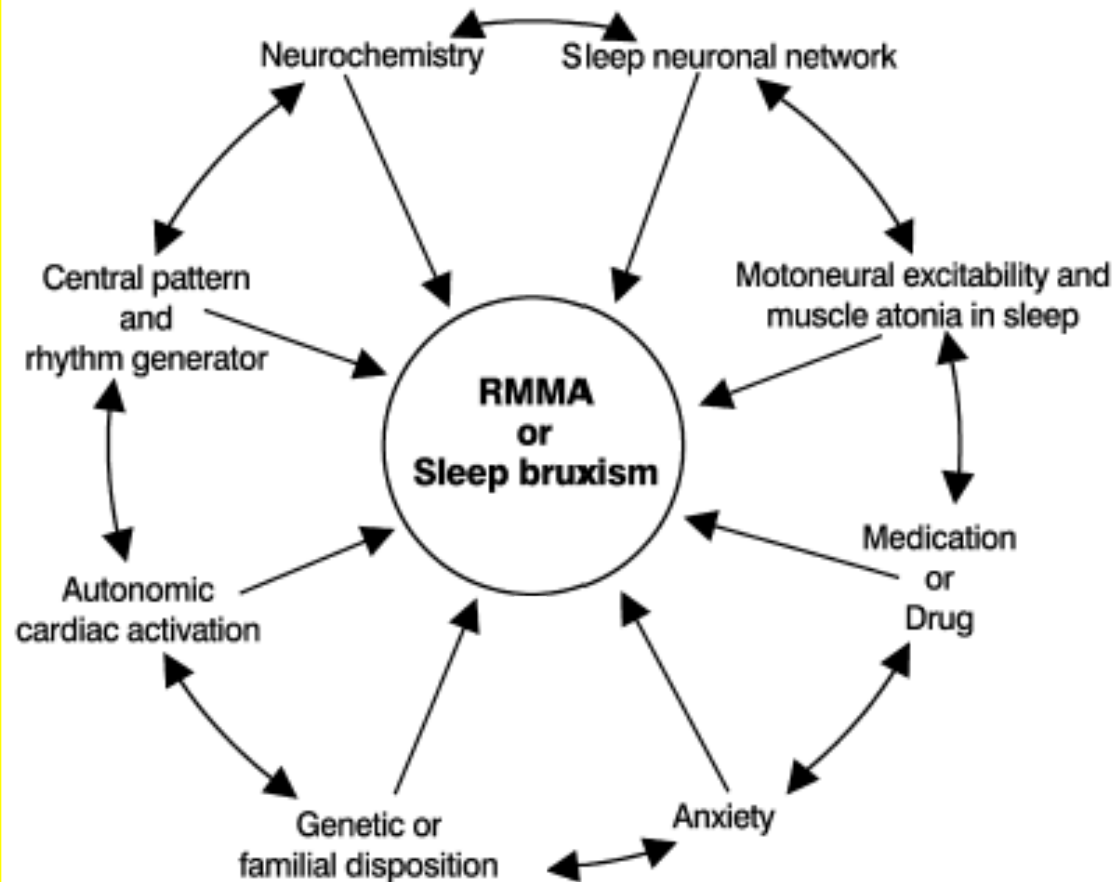
Lavigne & Montplaisir 1994

1. Summary

- Bruxism is a prevalent condition
- Awake bruxism is often associated with emotional tension or physical efforts
- Sleep bruxism is a movement disorder with increased rhythmic masticatory muscle activity related to sleep arousals

2. Why do we brux ?

**CNS
factors**



**Rhythmic
Masticatory
Muscle
Activity**

Lavigne et al. 2003
Lavigne et al. 2008

Pathophysiology of sleep bruxism

- Increased sympathetic activation of heart - 4 min
 - Decreased parasympathetic activation of heart
 - Increased EEG activity (arousal) - 4 s
 - Increased heart rate (tachycardia)
 - Increased suprahyoid EMG tonus - 1 s
 - Increased inspiration (nasal flow)
 - RMMA
- 
- BRUXISM

Importance of autonomic system

- Over 90% of sleep bruxism events can be predicted by an increasing heart rate (tachycardia > 110%) with high sensitivity (92%) and specificity (99%)
- Jaw muscle activity seems to be strongly related to changes in autonomic regulation during sleep

Macro sleep in sleep bruxers

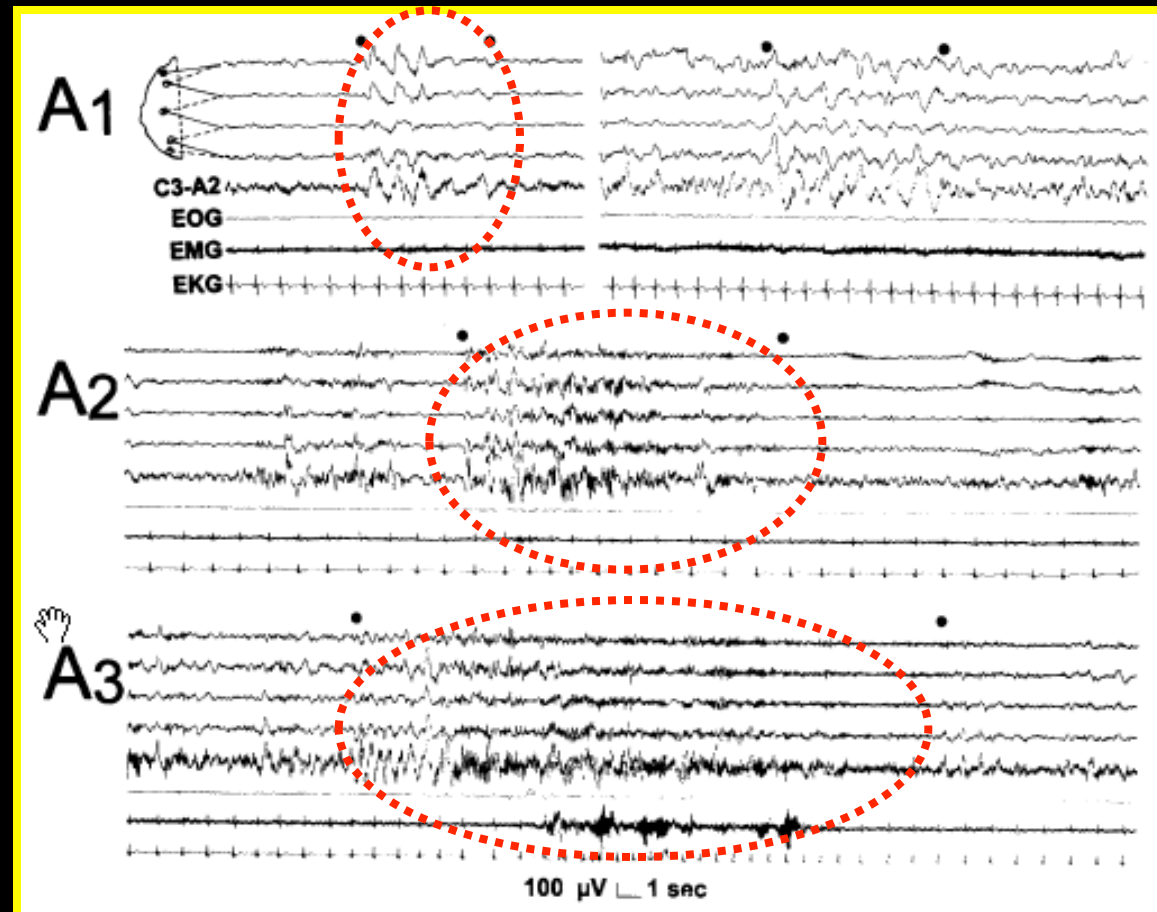
	SB (n=6)	CTR (n=6)	
Total sleep time (min)	430 ± 55	454 ± 40	ns
Sleep latency (min)	19 ± 11	18 ± 16	ns
Wake after sleep onset	26 ± 20	9 ± 12	ns
Stage 1 (min)	29 ± 16	14 ± 10	ns
Stage 2 (min)	226 ± 36	237 ± 45	ns
Stage 3 + 4 (min)	98 ± 16	91 ± 16	ns
Non-REM (min)	353 ± 34	342 ± 44	ns
REM sleep (min)	76 ± 26	112 ± 19	ns
REM latency (min)	90 ± 13	79 ± 20	ns

Cyclic Alternating Pattern (CAP)

CAP A phases (1-3) transient EEG events > background = B phases

A-B phases recur periodically (20-40 s)

nCAP Interval between A phases > 60 s



Mild arousal

Unstable, but maintained

Moderate arousal

Transition

High arousal

Muscle tone increase

EKG-respiration increase

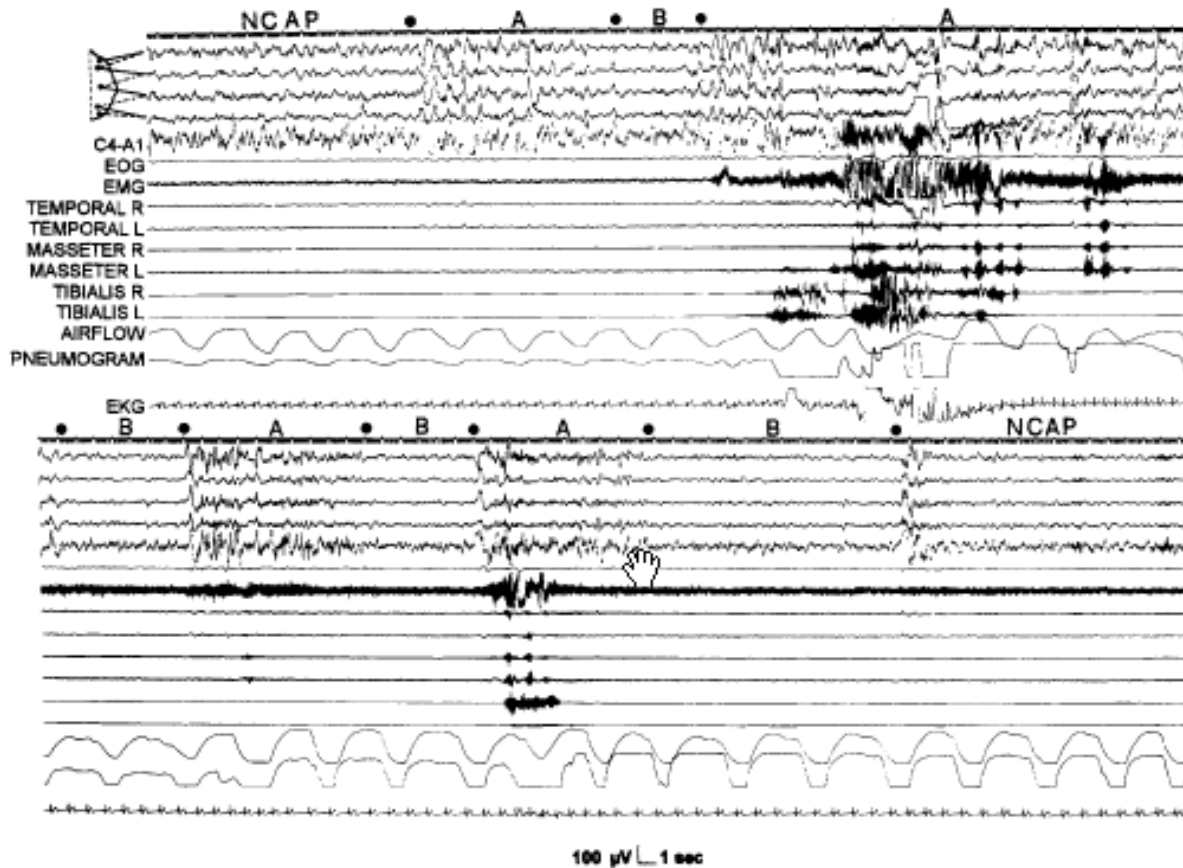
Micro sleep in sleep bruxers

	SB (n=6)	CTR (n=6)	
CAP time (min)	117 ± 27	107 ± 24	ns
CAP rate (%)	34 ± 6	31 ± 5	ns
CAP cycles (number)	259 ± 76	246 ± 78	ns
CAP cycles (s)	28 ± 3	27 ± 6	ns
Phase A (s)	11 ± 1	10 ± 1	ns
Phase B (s)	16 ± 2	17 ± 5	ns

Subtle differences in phase A

Macaluso et al. 1998

CAP analysis and bruxism



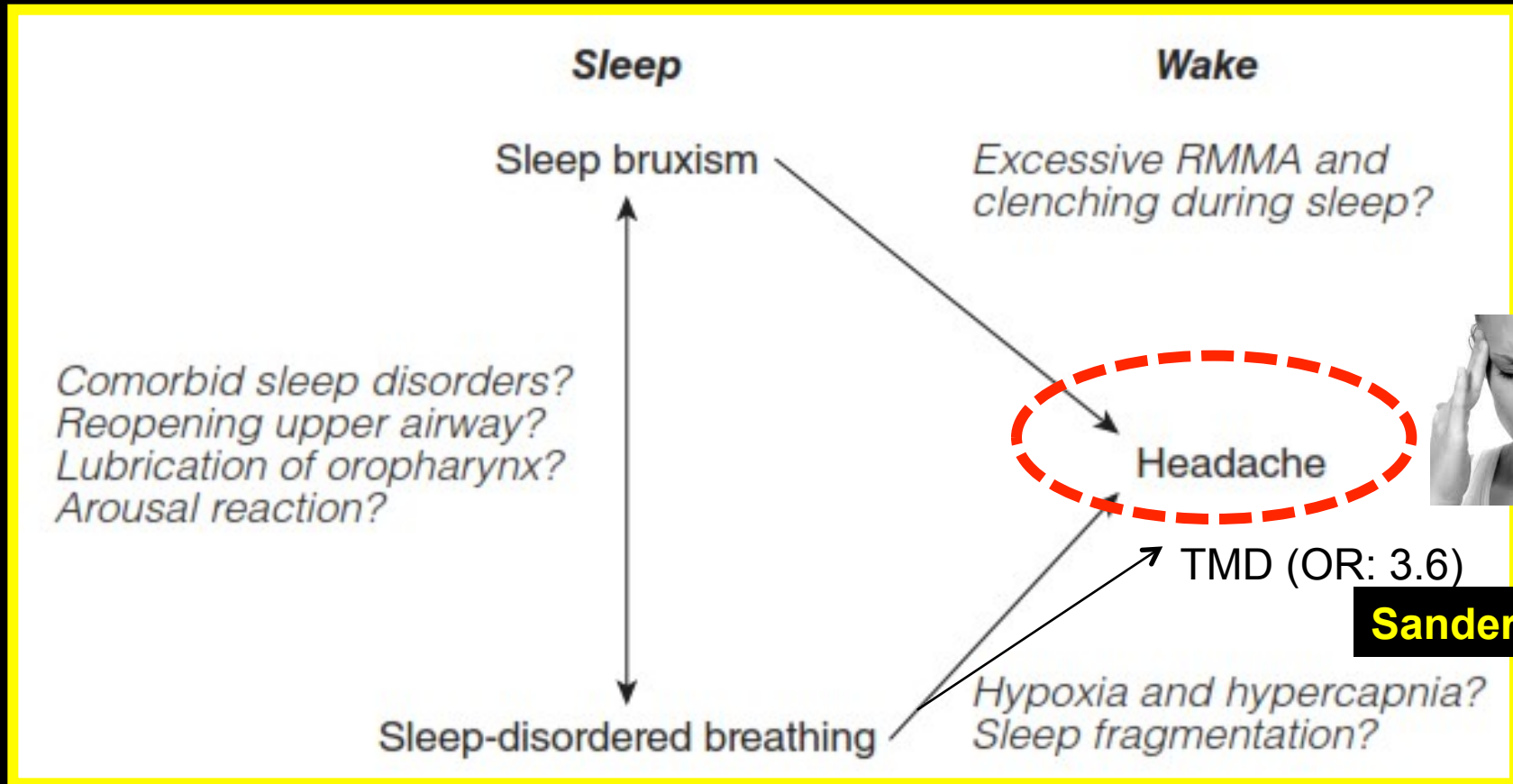
	SB n=6	CTR n=6
A1 (%)	46	69
A2 (%)	29	24
A3 (%)	25	7*

* $P < 0.0001$ (Chi-square)

Risk factors for self-reported SB

Factor	OR
Moderate "sleepiness" during day	1.3
Light snoring	1.2
Heavy snoring	1.4
Sleep apnea	1.8
Daily alcohol 1-2 glasses	1.5
Daily alcohol > 3 glasses	1.8
Daily caffeine-intake > 6 cups	1.4
Daily tobacco ~ 20 cigarettes	1.3
High stress	1.3
DSM-IV anxiety disorders	1.3

Bruxism and sleep-disordered breathing



Sanders et al 2013

Carra et al JOP 2012

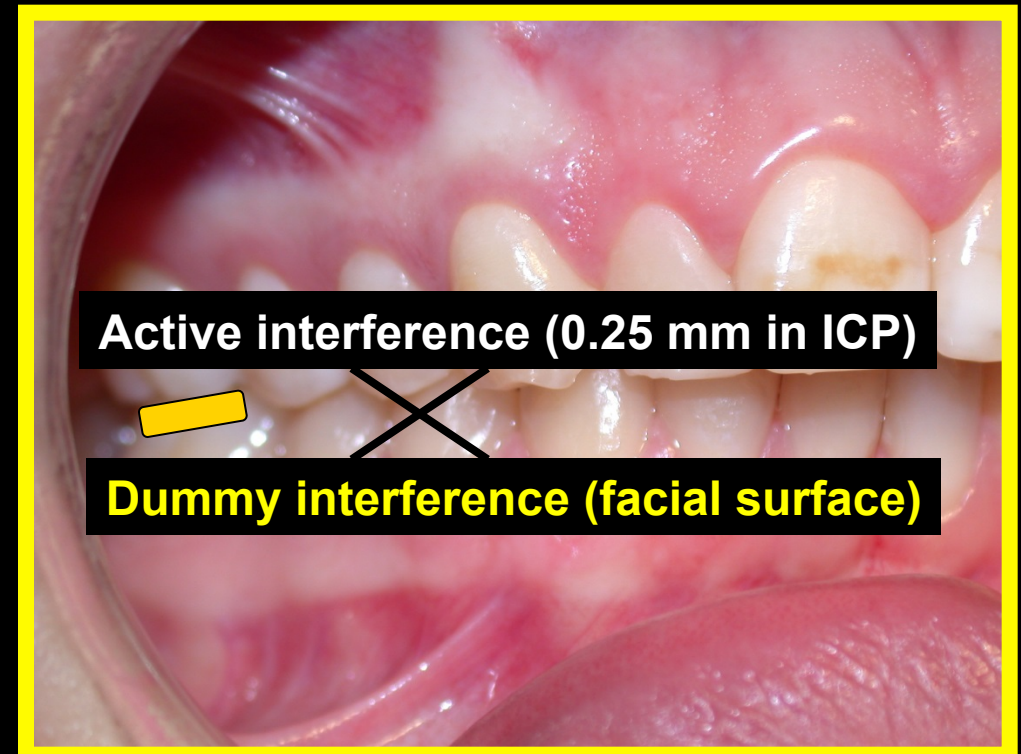
But what about occlusion
and bruxism ?

Occlusion and bruxism

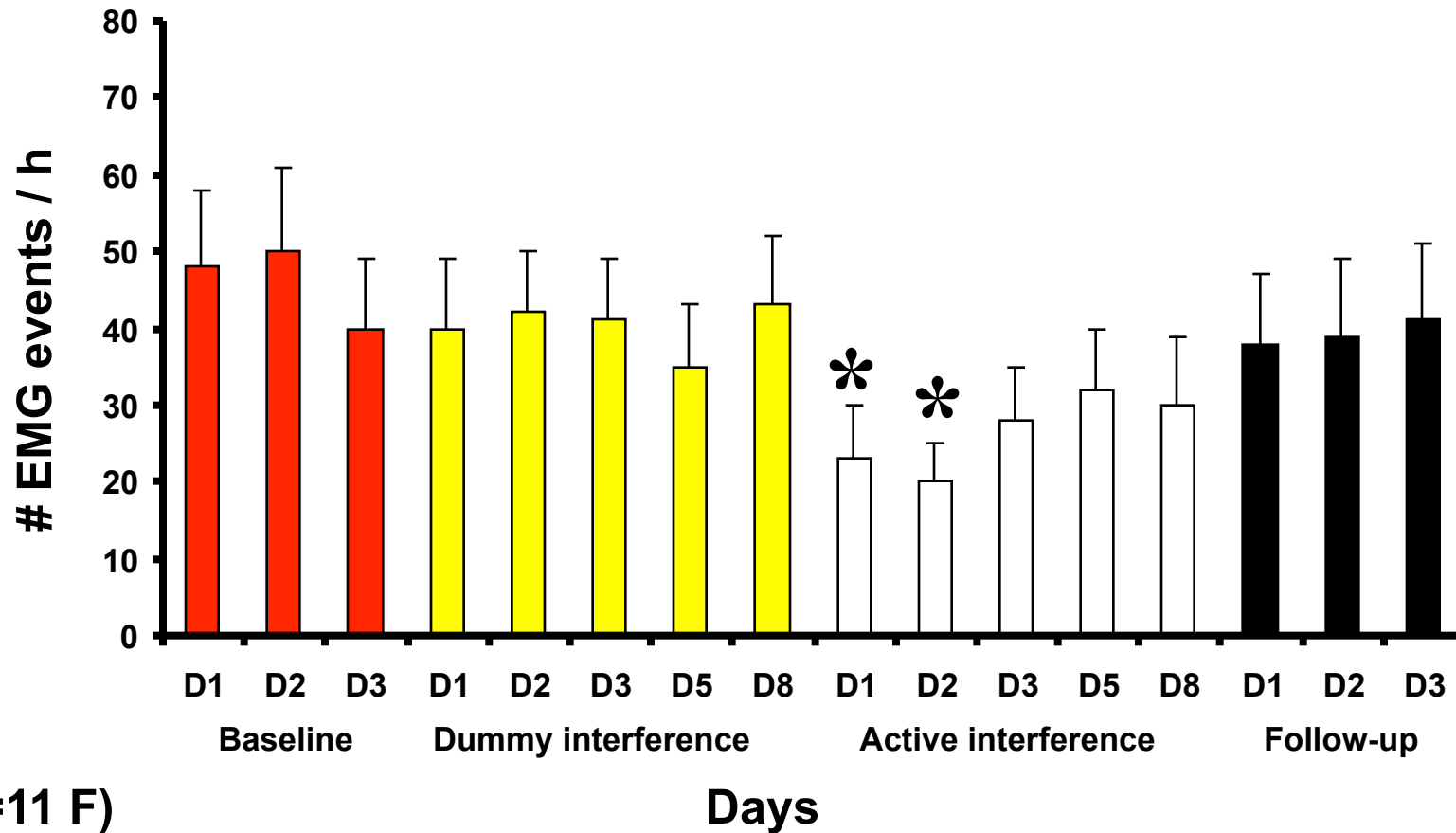
- “Occlusal grinding procedures (i.e., removal of discrepancies between RCP & ICP) always lead to a disappearance of bruxism”

Old dogma but still believed to be true by many !

Human experimental study

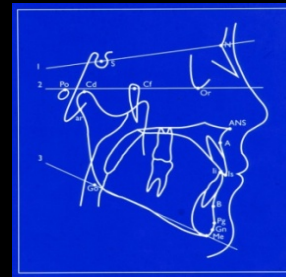


Influence of occlusal interferences



Craniofacial anatomy and bruxism

- **Case – control study**
 - 26 occlusal & 25 cephalometric variables
 - Bruxers versus non-bruxers (PSG-confirmed)
 - No differences between both groups
- Craniofacial anatomy seems unrelated to the etiology of bruxism



Importance of occlusion for bruxism

- There is a lack of evidence to support any strong relationships between occlusal variables / craniofacial morphology and bruxism

2. Summary

- Bruxism is mainly regulated and influenced by CNS factors
- Occlusion (e.g. occlusal interferences) is not critically involved

3. Assessment of bruxism

- History
 - Interview
 - Questionnaires
- Clinical examination
 - Extra-oral
 - Intra-oral
- Additional tests
 - Polysomnography (PSG) in sleep labs
 - Portable EMG (electromyography)

Clinical diagnosis

- History
 - "Are you aware of clenching or grinding your teeth during day time"
 - "Are you aware of clenching or grinding your teeth during sleep"
 - "Do you wake up with tender or painful jaw muscles"
 - "Do you wake up with sore teeth"

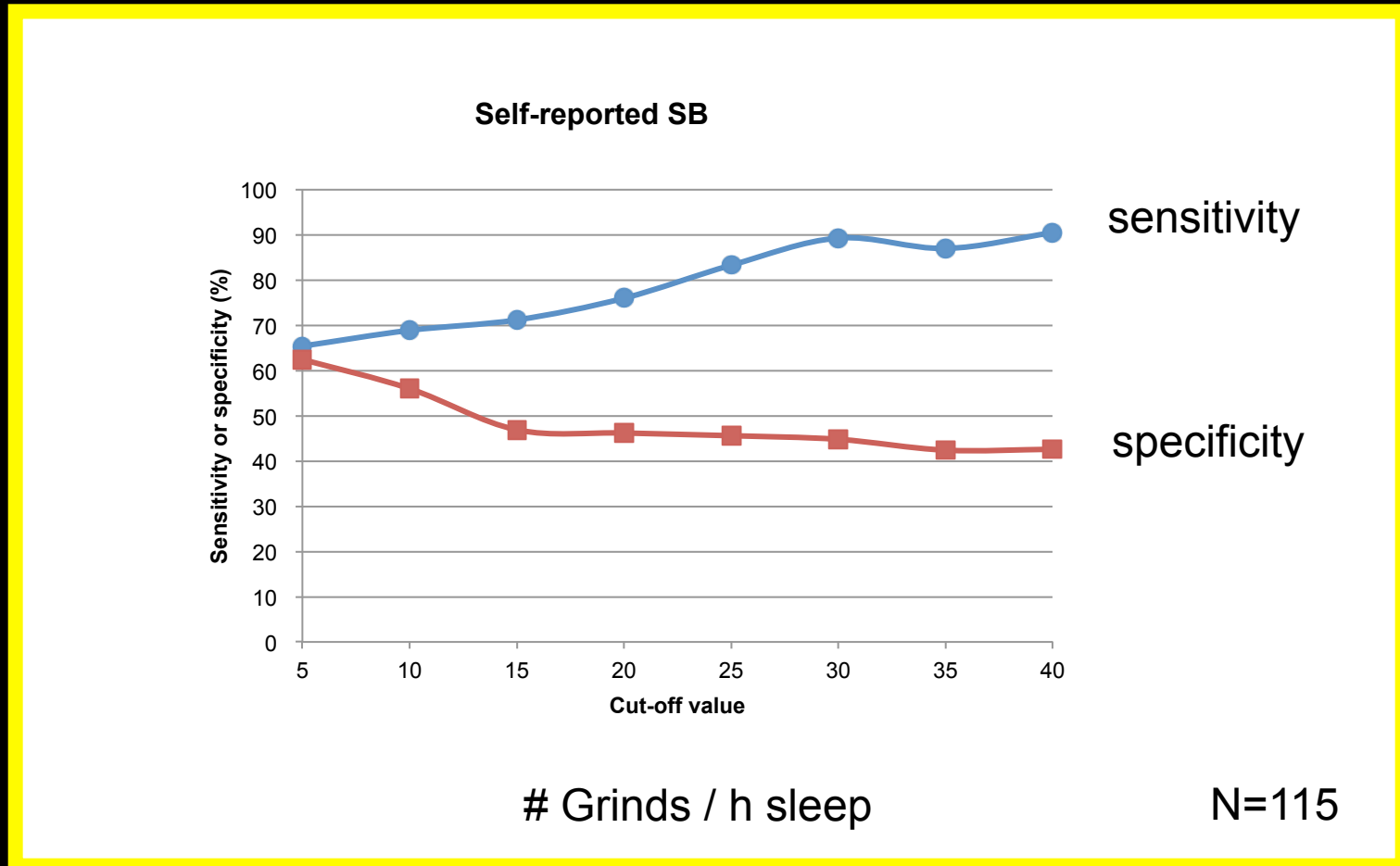
Problems with self-reports

- 18% of subjects that report sleep bruxism meet PSG criteria for sleep bruxism

BUT

- 19% of subjects that do NOT report sleep bruxism also meet PSG criteria

Self-reports of bruxism



Clinical examination

- Intraoral
 - Hyperkeratosis
 - Tongue scalloping
 - Cheek biting



Findings:
+ present
- absent



Clinical examination

- Tooth / implant fractures
- Occlusion / articulation
 - Change in morphology
 - Functional facets / attrition



Grading attrition



Problems with attrition

- Not specific indicator of ongoing bruxism
 - No differences in attrition scores between light / mild and moderate / strong sleep bruxers
 - 100% of sleep bruxers have attrition BUT 40% of non-sleep bruxers also have attrition

Splink =
Splint + Ink

Assessment of wear

Baseline

After 1 week

Case 1



No correlation between EMG activity and wear
($r = -0.063$; $P=0.834$, $n = 12$)

Case 2



Yachida et al. 2013 – in prep

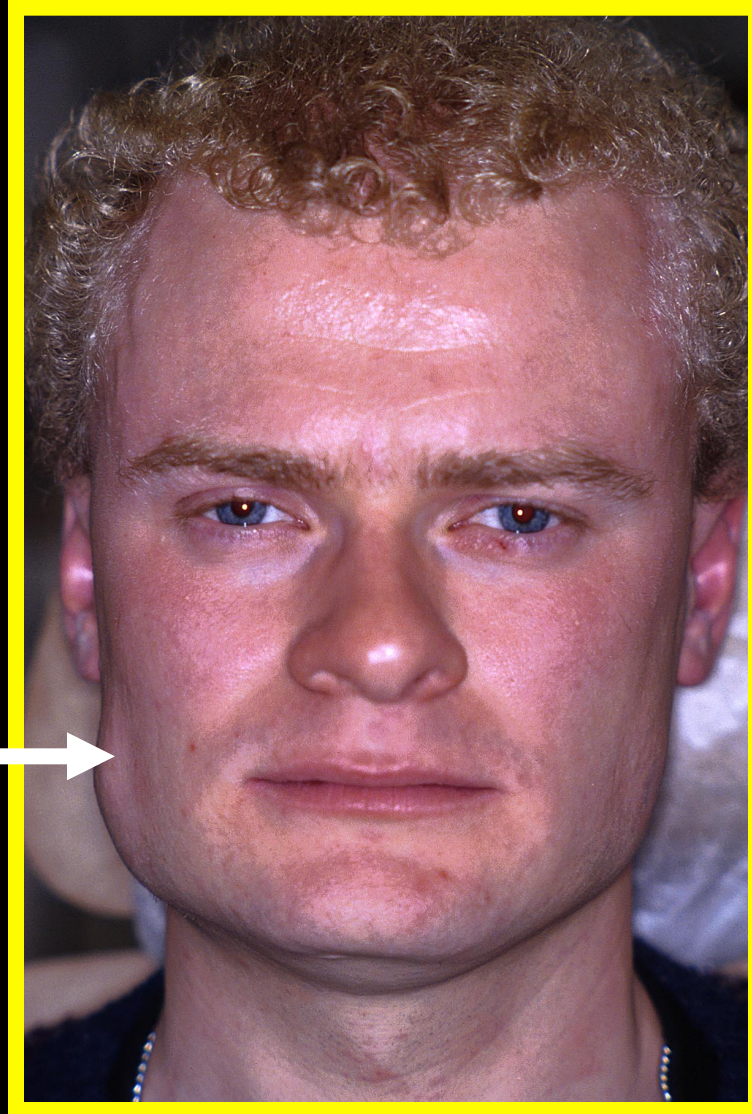
Clinical examination

- Extra-oral

Form - hypertrophy

Consistency

Pain sensitivity



3. Summary

- A careful history + clinical examination can provide strong indications of awake and sleep bruxism ("possible" – "probable")
- However, diagnosis is mainly based on potential consequences of bruxism, i.e., indirect assessment
- Additional measures needed for a direct assessment ("definite")

Additional tests

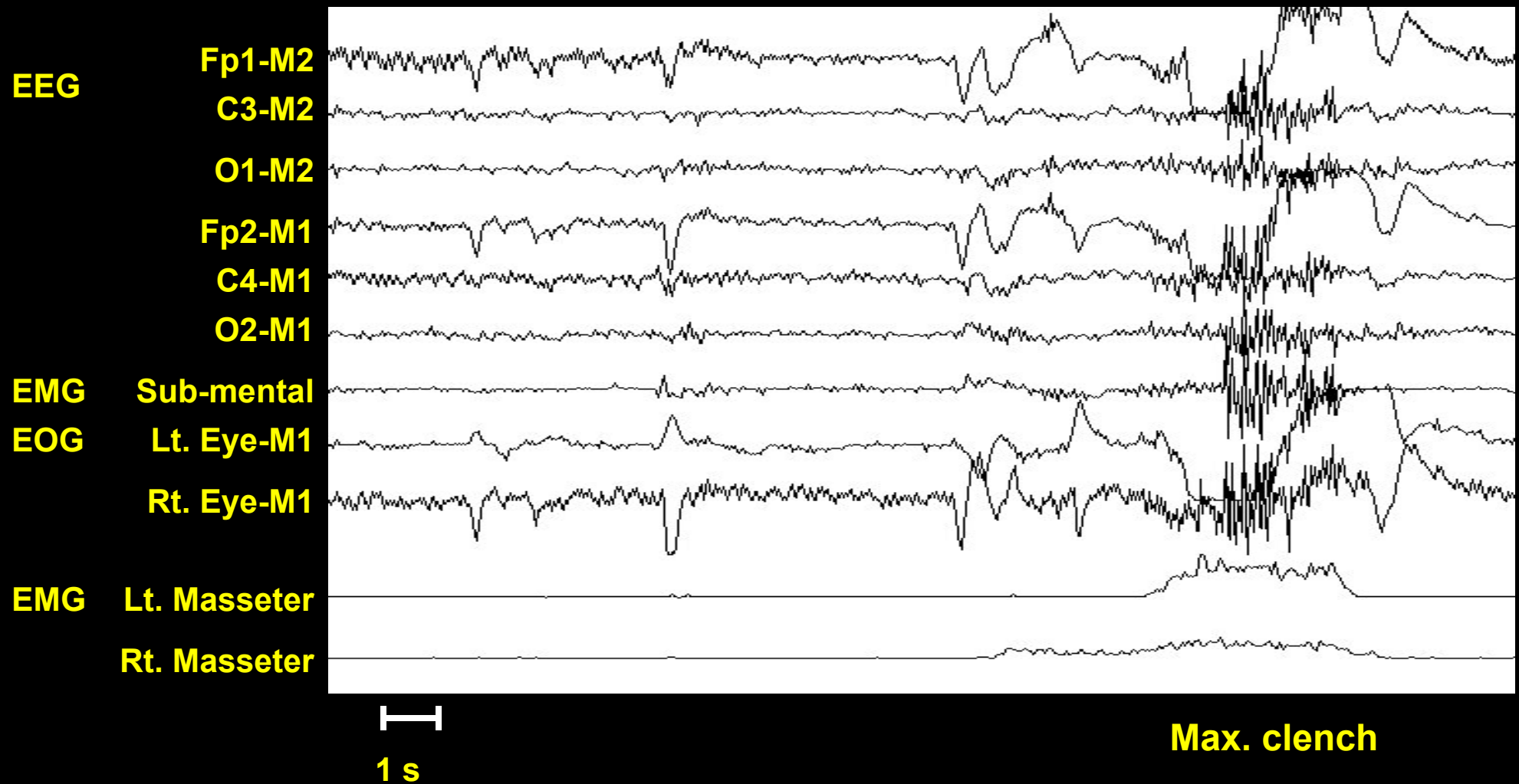
- Sleep laboratory
 - Full polysomnography (PSG)
 - Video
 - Audio
- Ambulatory recordings
 - Portable PSG
 - Single channel EMG

Polysomnography



Arima et al. 2001

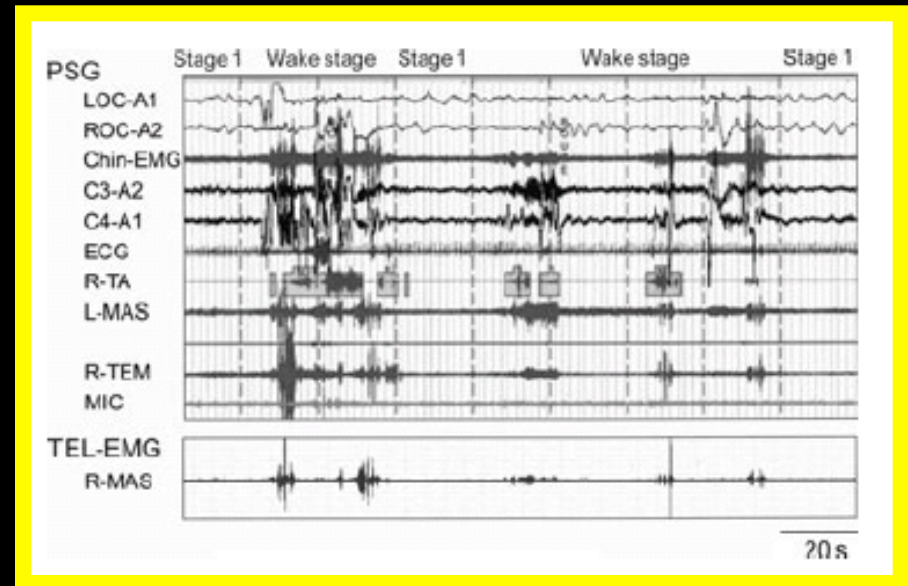
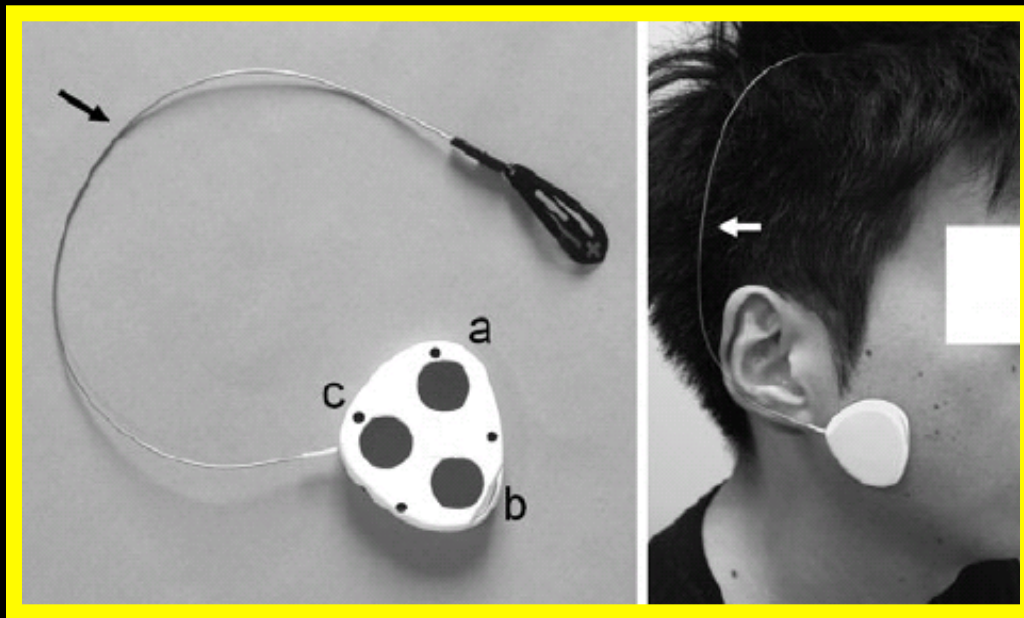
Example



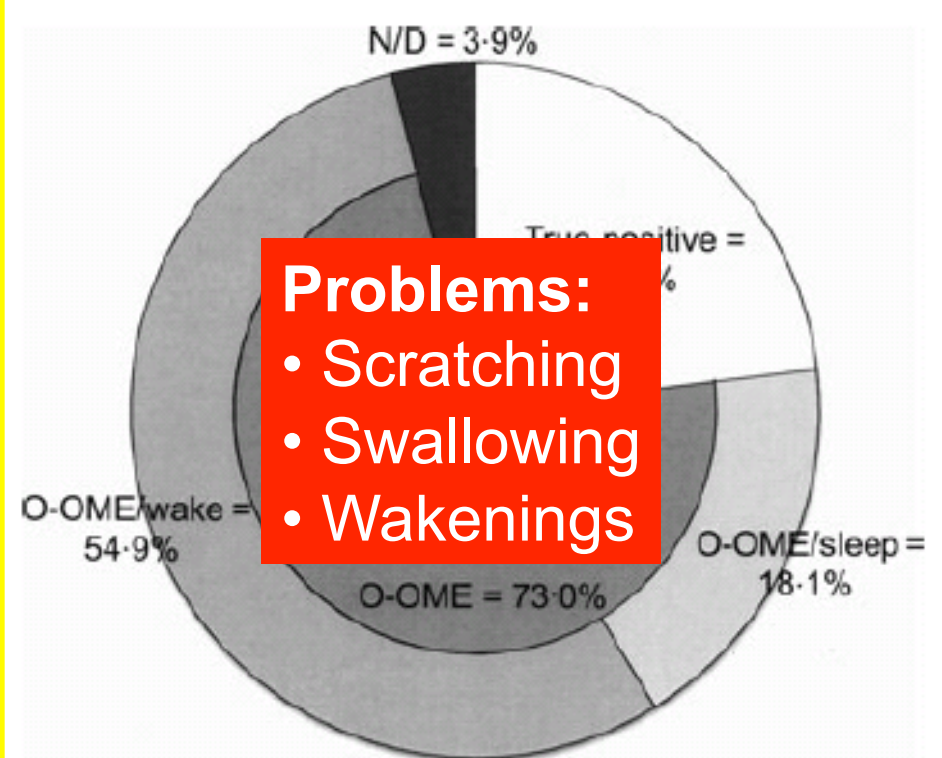
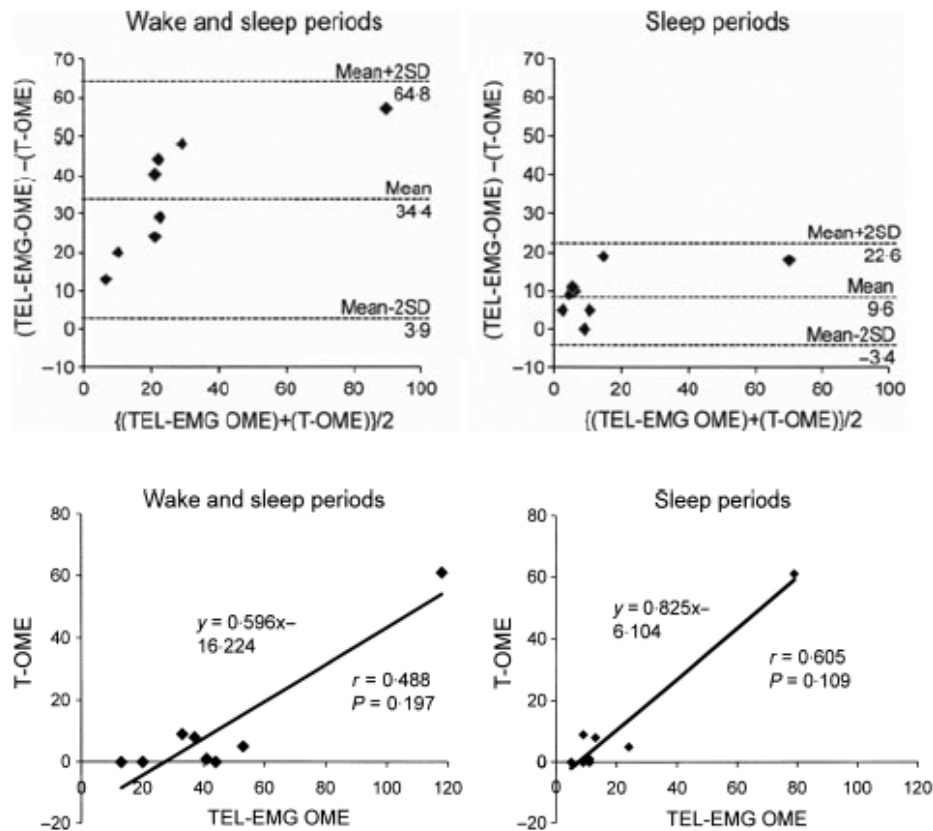
Single channel EMG devices

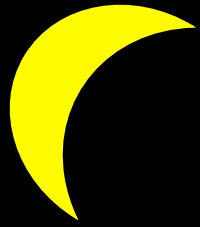


Single channel EMG vs PSG



Single channel EMG vs PSG



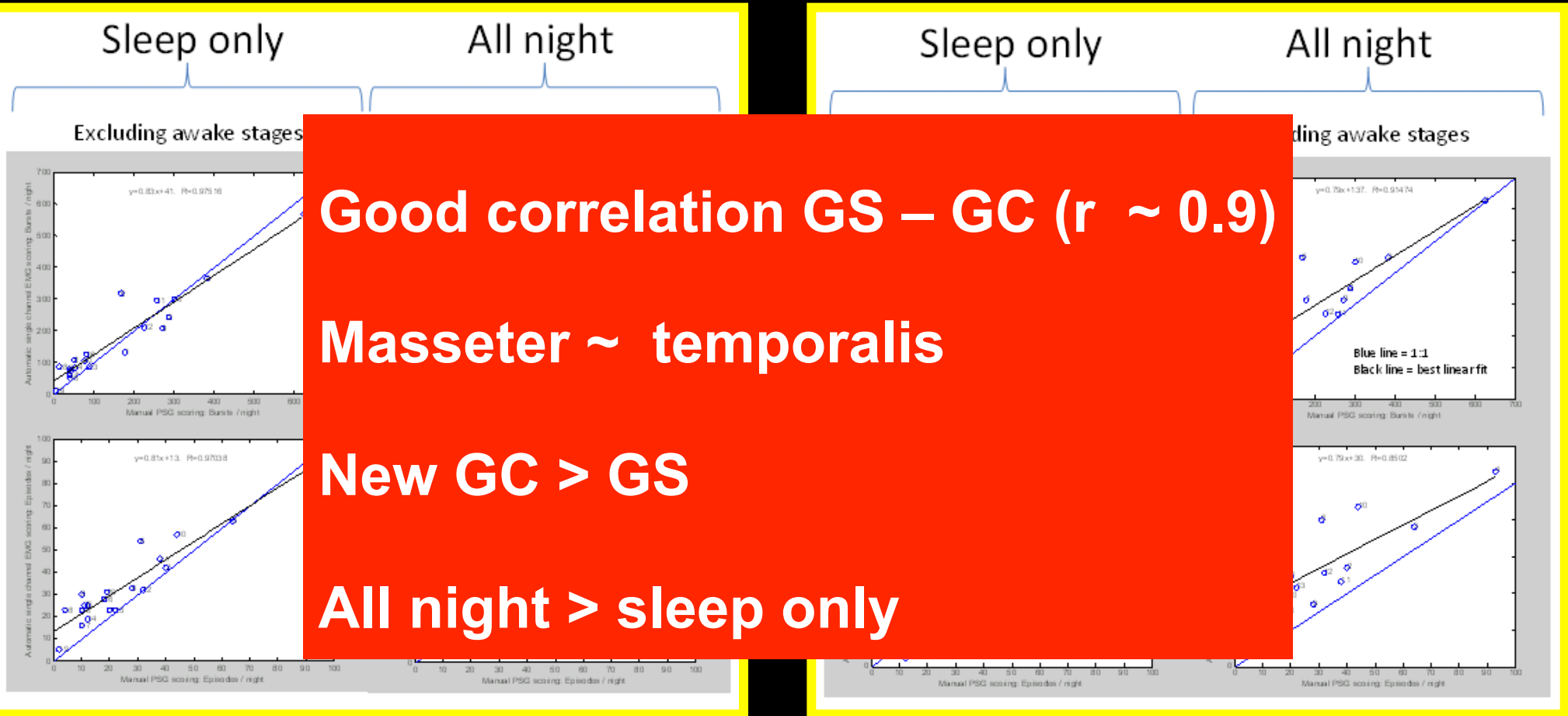


Single channel EMG device

Grindcare version3®



Correlation between "gold standard" and new GC algorithm



(n=20)

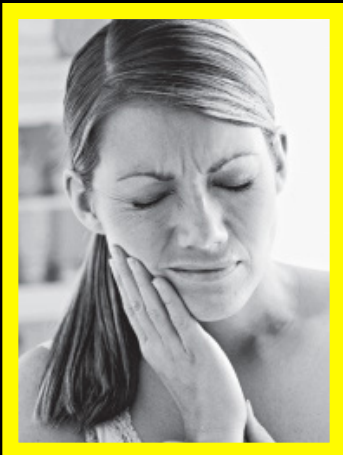
Haugland et al. – in progress - 2013

3. Summary

- Single channel EMG recordings from the anterior temporalis muscle can provide reliable estimates of jaw muscle activity related to bruxism but may contain "false-positive" events

4. What can bruxism cause?

- Attrition / tooth destruction
- Disturbance of bed partner's sleep
- Muscle hypertrophy
- Headache / jaw pain / TMD pain ?



Damage to implants ?

- Biological problems (implant failure / mobility, bone loss
 - Seems rare (6 / 14 studies; 8 / 14 inconclusive)
- Mechanical problems (complications / failures of suprastructures)
 - Seems frequent (4 / 7 studies)

Bruxism and TMD pain

Multiple types of TMD pain

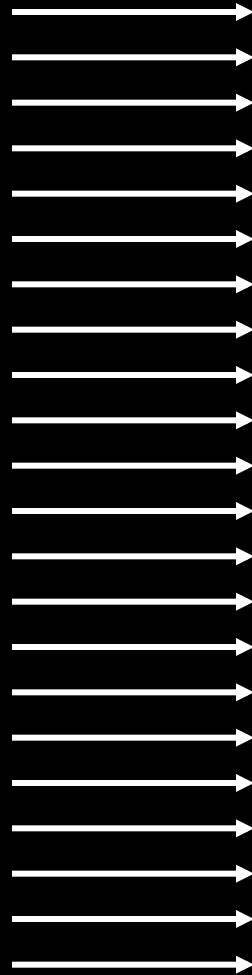
- Type
 - Nociceptive
 - Inflammatory
 - Neuropathic
 - Functional
- Duration
 - Acute
 - Chronic
- Intensity
 - Low
 - Moderate
 - High
- Frequency
 - Episodic
 - Frequent
 - Constant

>> 4 x 2 x 3 x 3 = 72 different types of pain

e.g. Inflammatory – acute – low - frequent

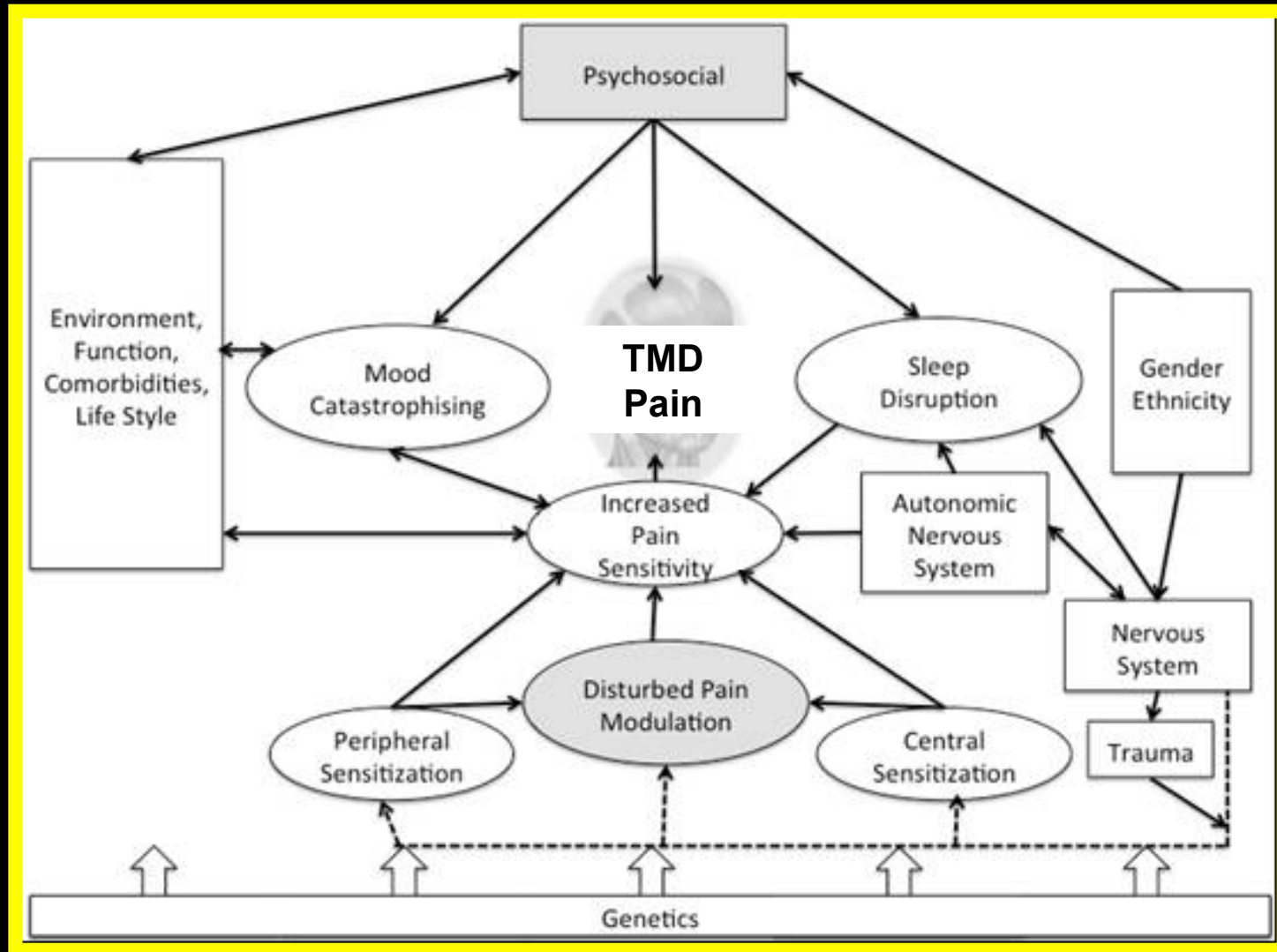
Very complex relationships

Bruxism
(>108)

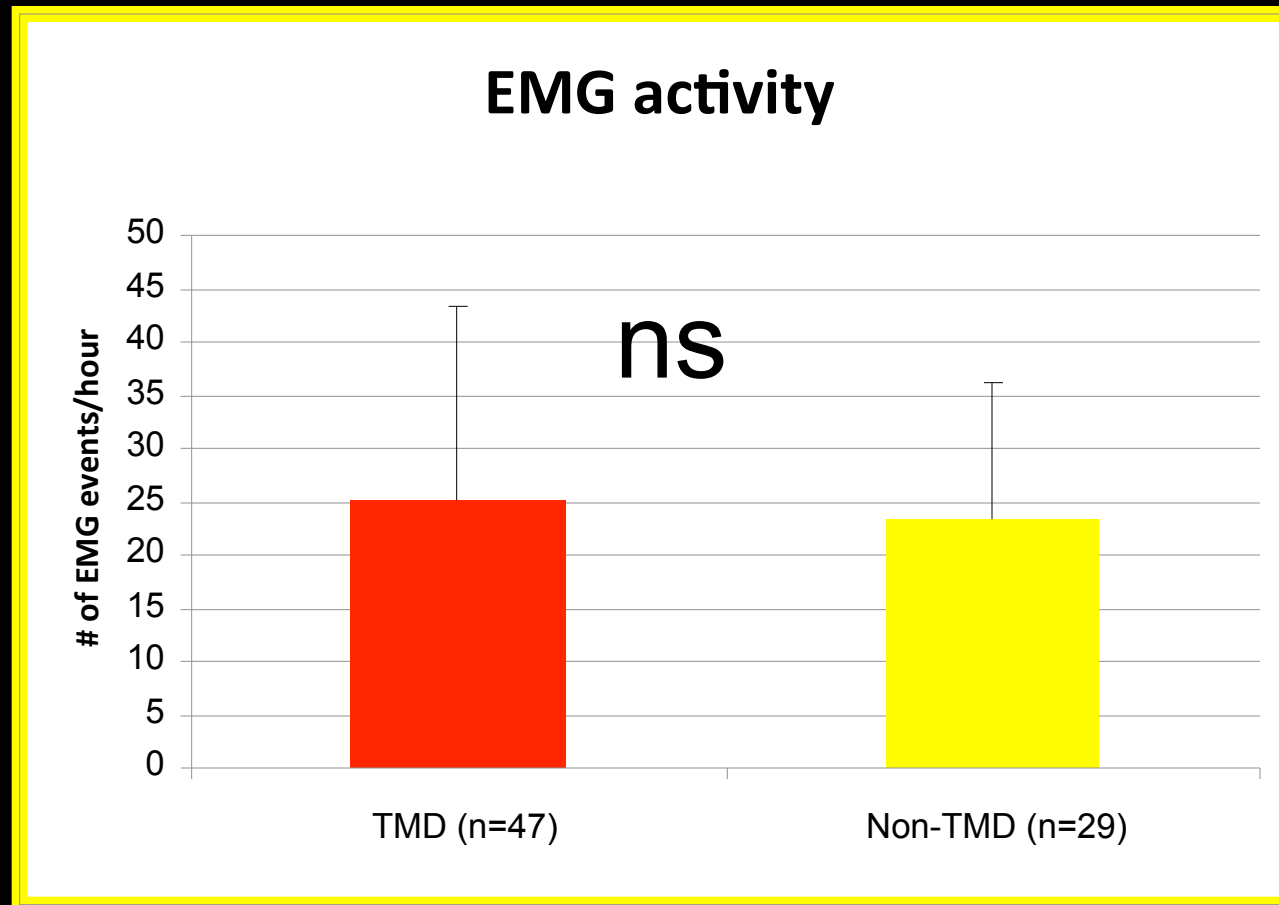


Pain
(>72)

Complex TMD pain model



EMG activity in TMD patients



Yacida et al. 2012

4. Summary

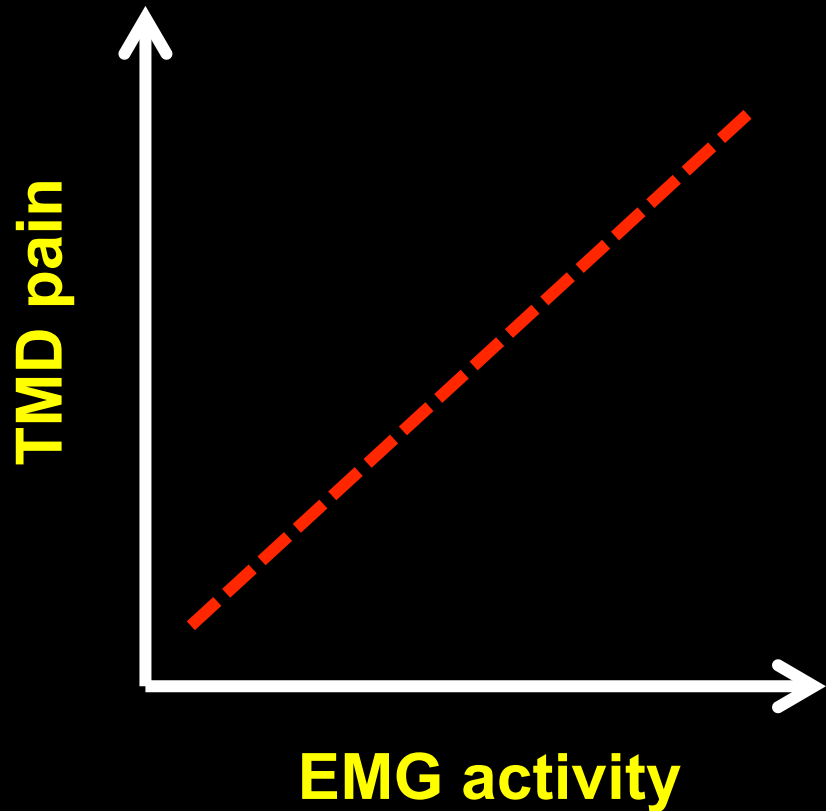
Bruxism causes pain



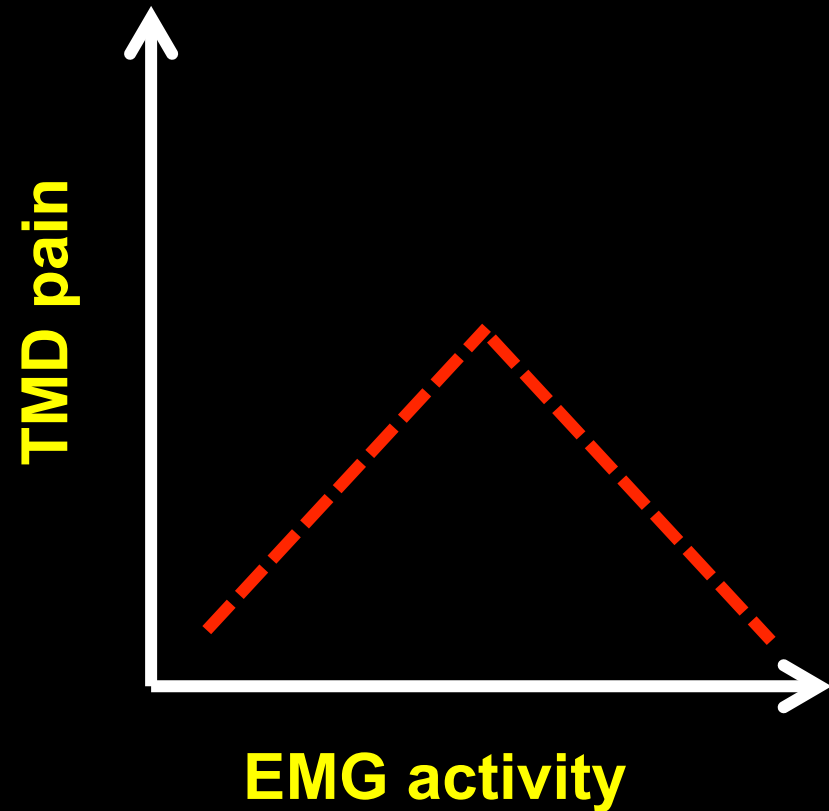
***Some* types of bruxism
may cause *some* types of pain**

Relationships

Linear



Non-linear



5. Management of bruxism

- Occlusal splints
- Information / counseling
- Physiotherapy
- Pharmacology
- Feedback-systems

Occlusal splint



RCT study on sleep bruxism

a

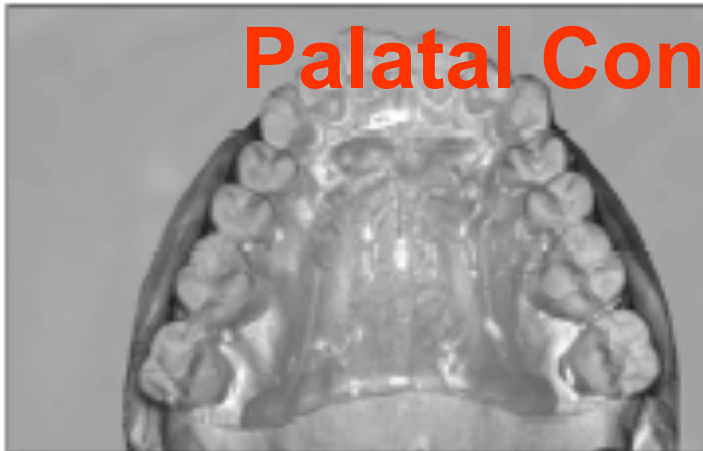


Occlusal splint (OS)

b

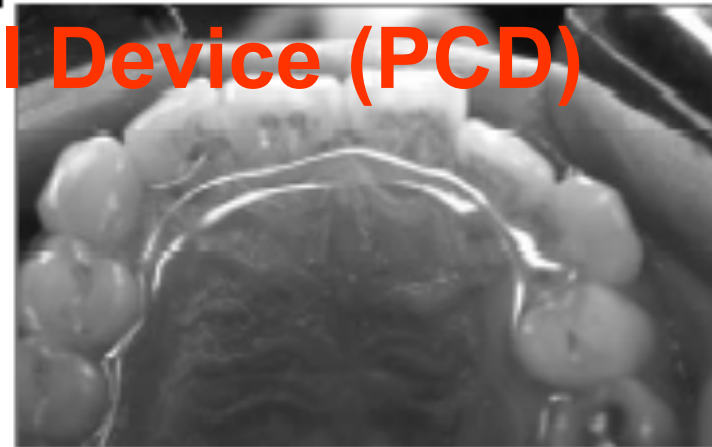


c

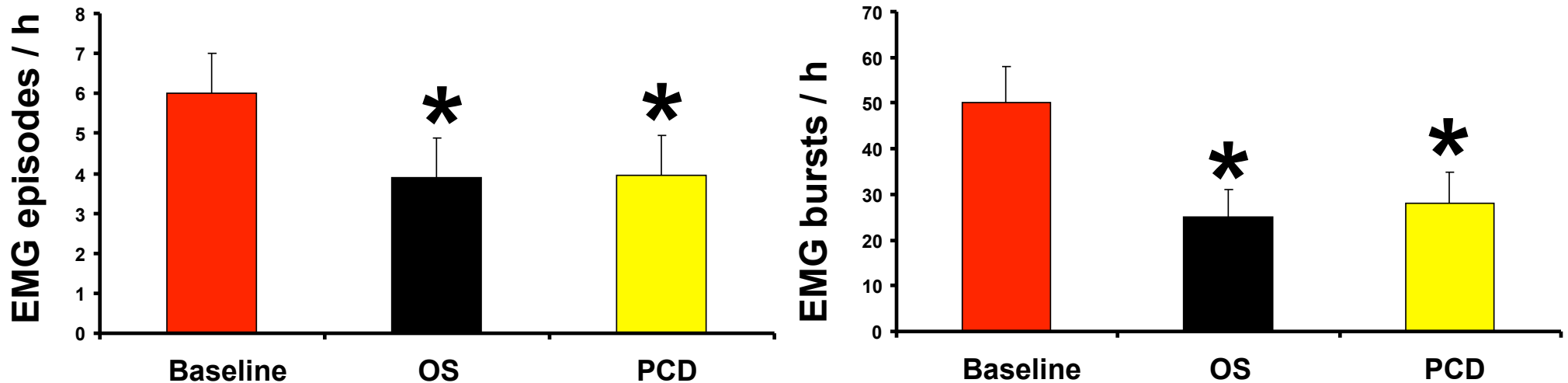


Palatal Control Device (PCD)

d



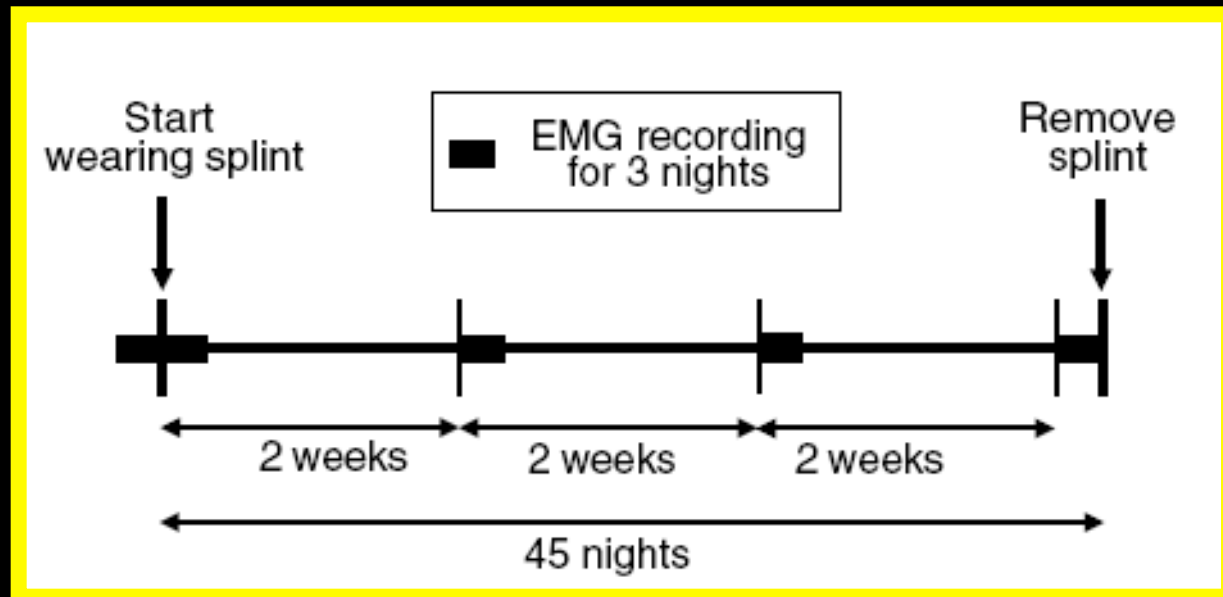
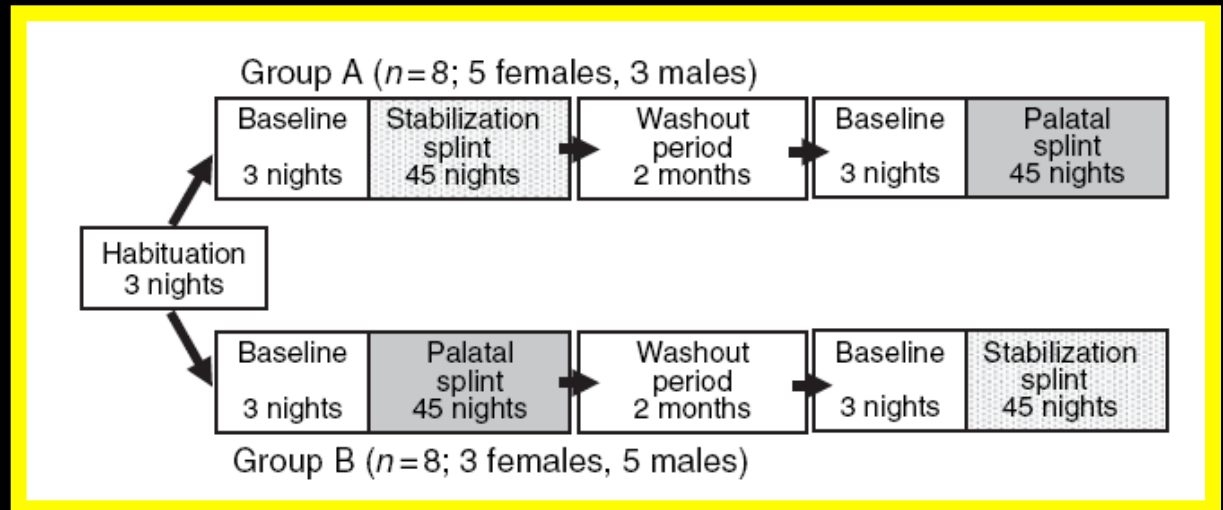
RCT study on sleep bruxism



(n = 9)

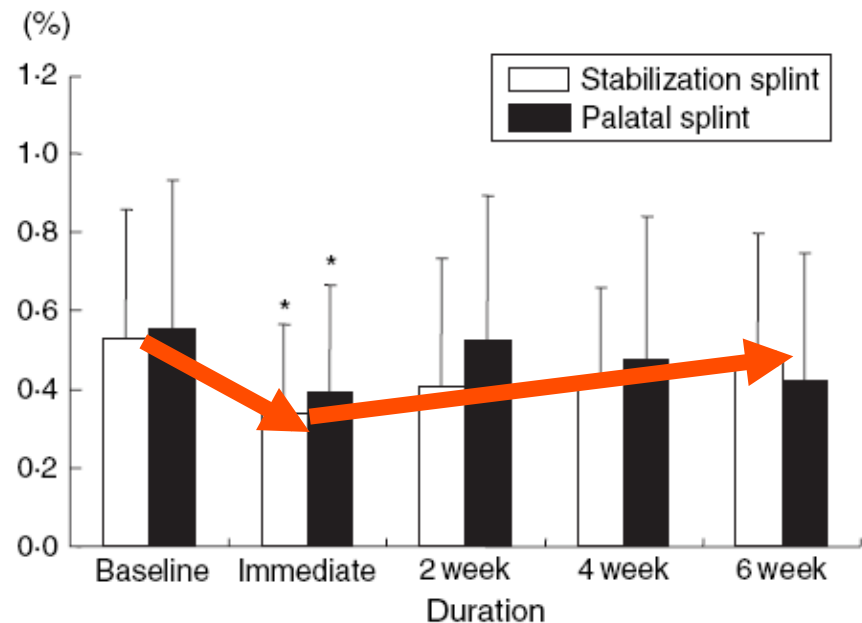
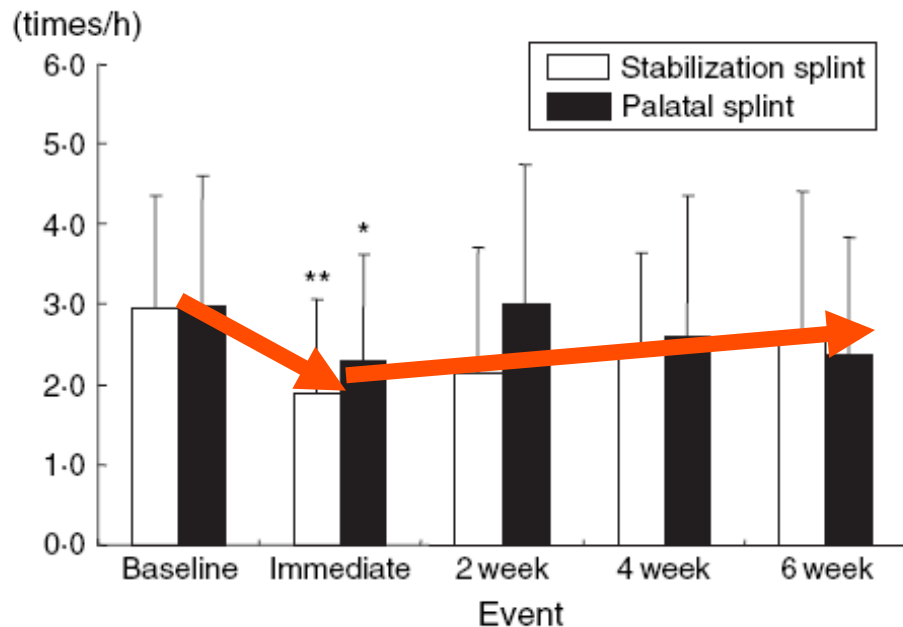
Dubé et al. 2004

RCT study on long-term effects



No long-term effects of splints !

Fits clinical observation of wear on splints
Bruxism continues !



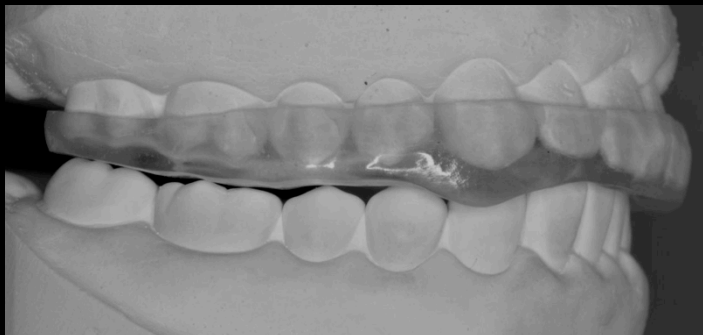
Different types of splints



**Restrict Maxillary and
Mandibular Occlusal
Appliance**

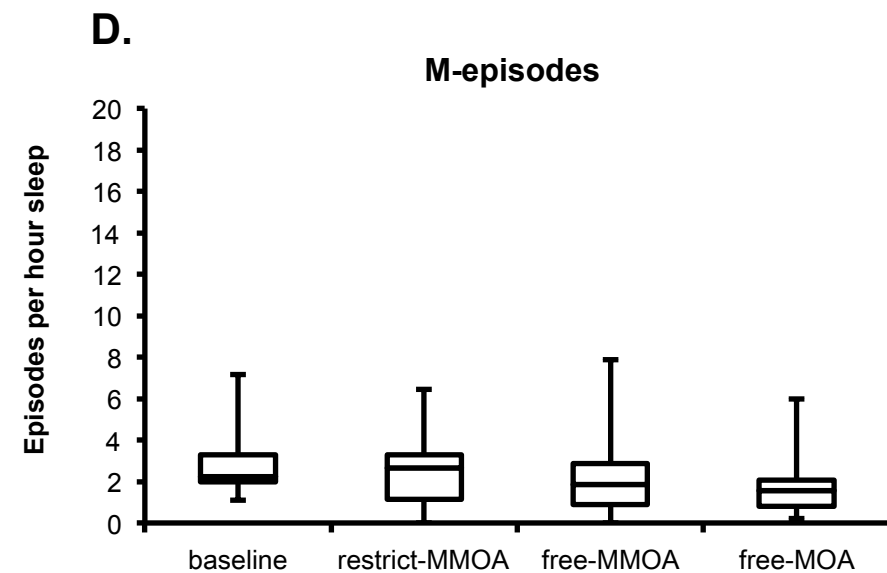
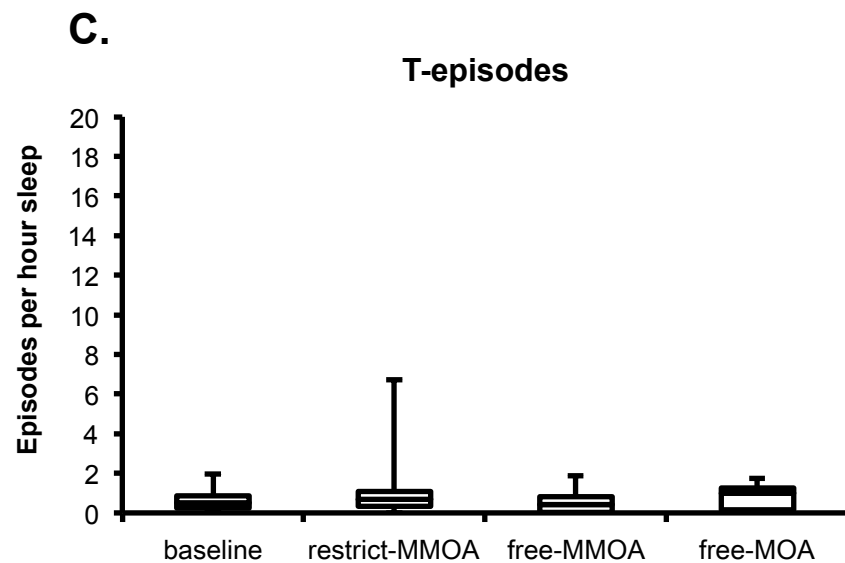
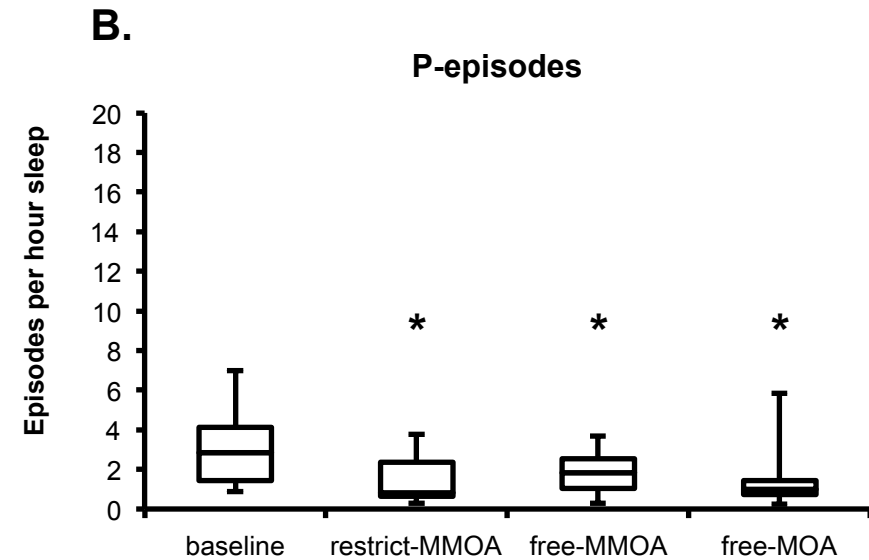
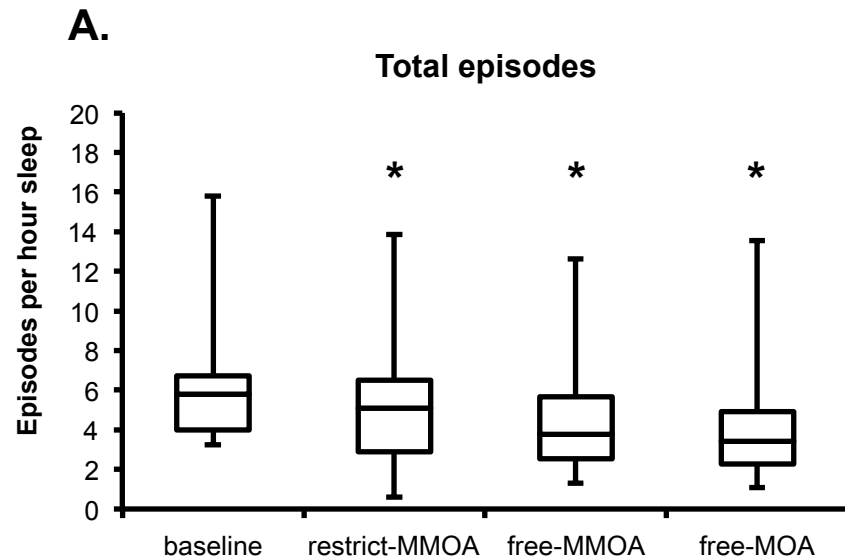


**Free Maxillary and
Mandibular Occlusal
Appliance**



**Free Maxillary
Occlusal Appliance**

Immediate effects



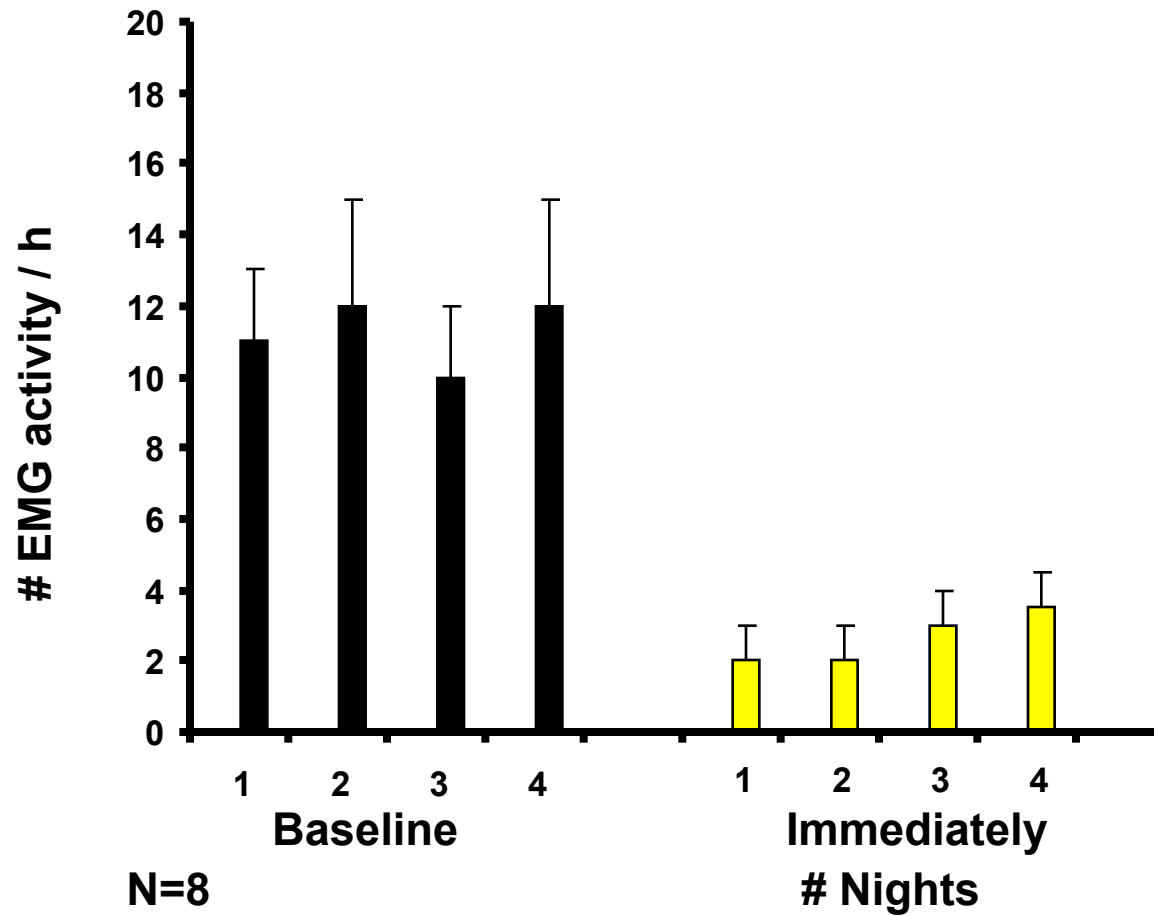
Mandibular advancement device

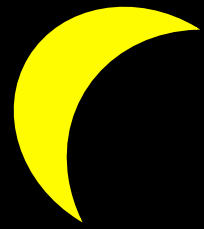


Decrease in EMG activity by ~ 40%

OBS: Frequent adverse effects with pain in TMJ / muscles

Effect of MAD on EMG activity





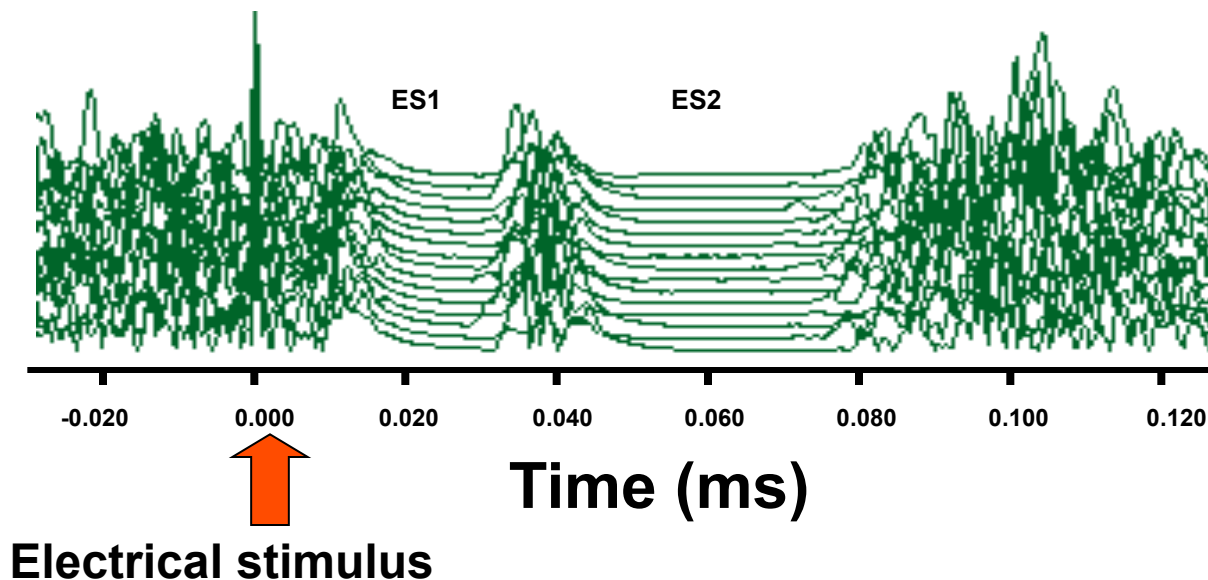
Portable EMG device + stimulation

Grindcare version3®



Inhibition of EMG activity

Exteroceptive Suppression Reflex (ES)



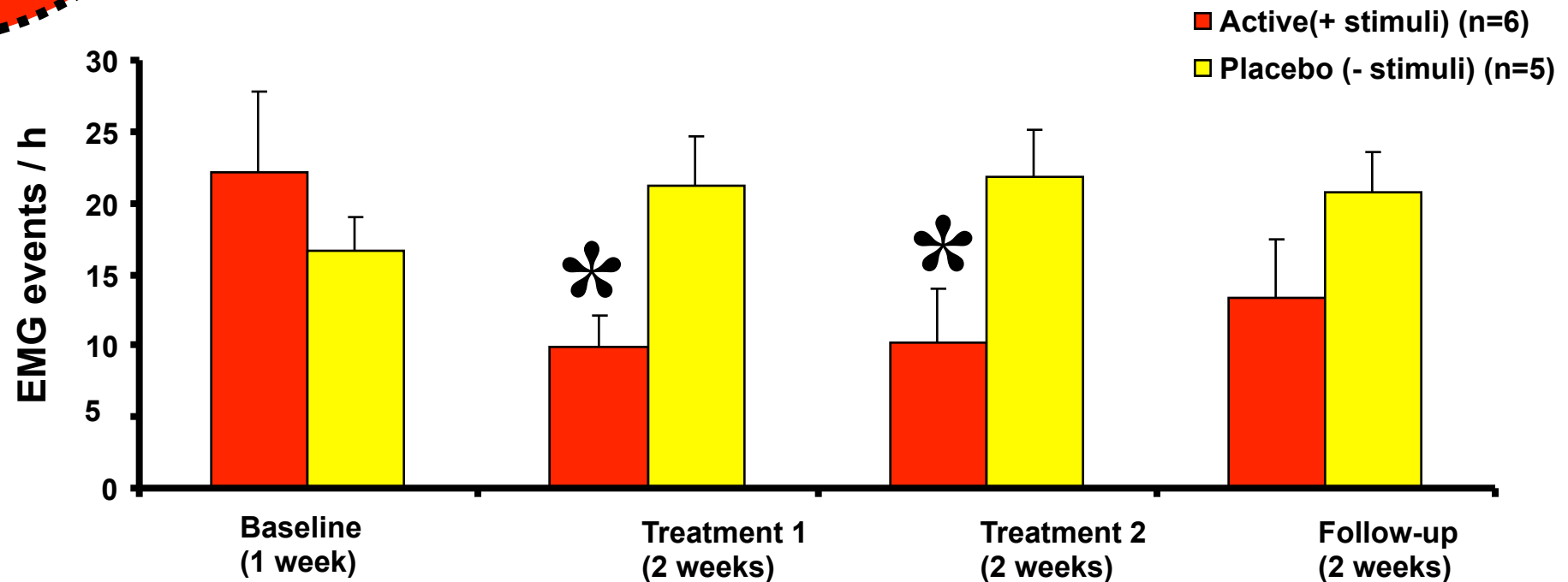
Svensson et al. 1998, 1999, 2000; Lund et al. 2008
Wang et al. 2001, 2002, 2005; Toriso et al. 2008

Use of EMG feedback

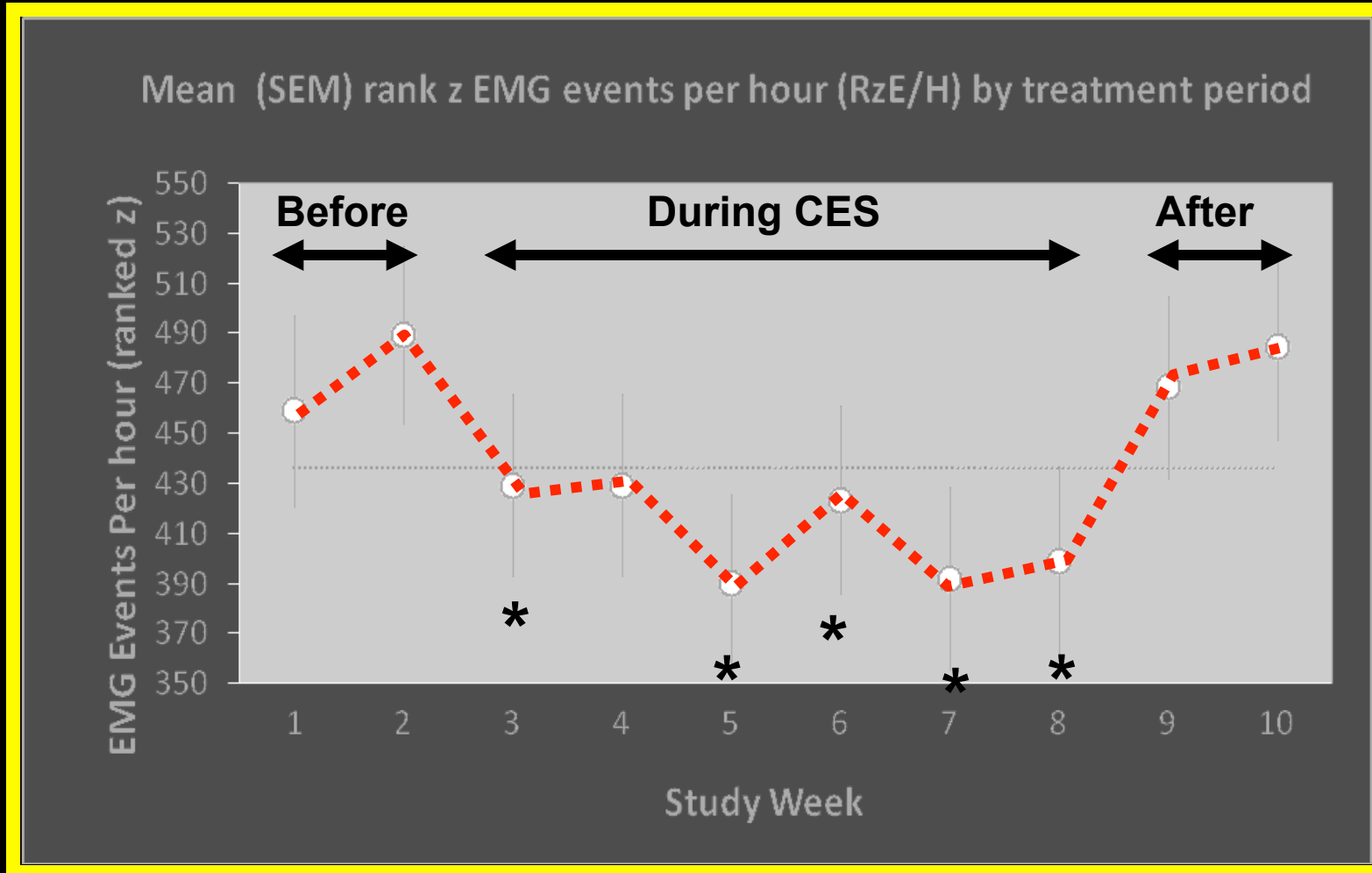


Randomized controlled trial

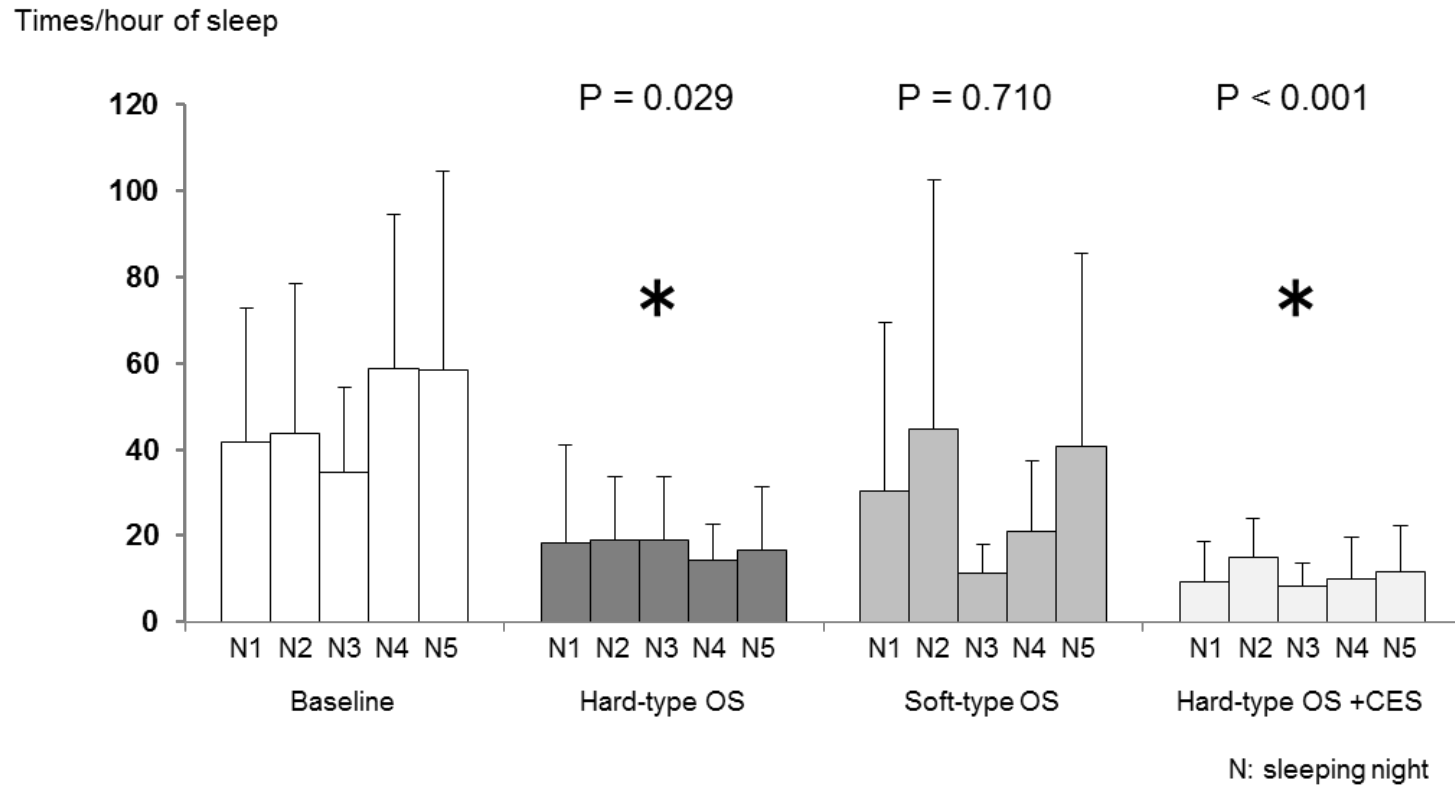
NEW !



Case-series study



Occlusal splints + CES



Summary



- Single channel EMG devices offer the possibility to assess jaw muscle activity during sleep (multiple nights) at low costs
- Contingent stimulation may be used to inhibit muscle activity and manage bruxism

Take home message (1)

- Take history
- Do intra- and extraoral examination
- Consider if a more "definite" diagnosis is essential for management
 - PSG ?
 - Ambulatory EMG ?

Take home message (2)

- Bruxism can be managed – not cured !
 - Counselling and information always
 - Consider sleep-related problems (apnea)
 - Splints for tooth-protection if needed
 - Physiotherapy for muscle symptoms
 - Pharmacology rarely needed
 - Contingent electrical stimulation ?

Books

SLEEP MEDICINE FOR DENTISTS A PRACTICAL OVERVIEW

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QUINTESSENCE PUBLISHING

Dental Management of Sleep Disorders

Ronald Attanasio
and Dennis R. Bailey

WILEY-BLACKWELL

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