Why do we need to care about bruxism ?

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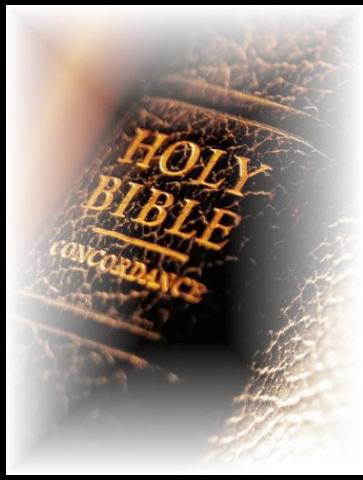
Agenda today

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

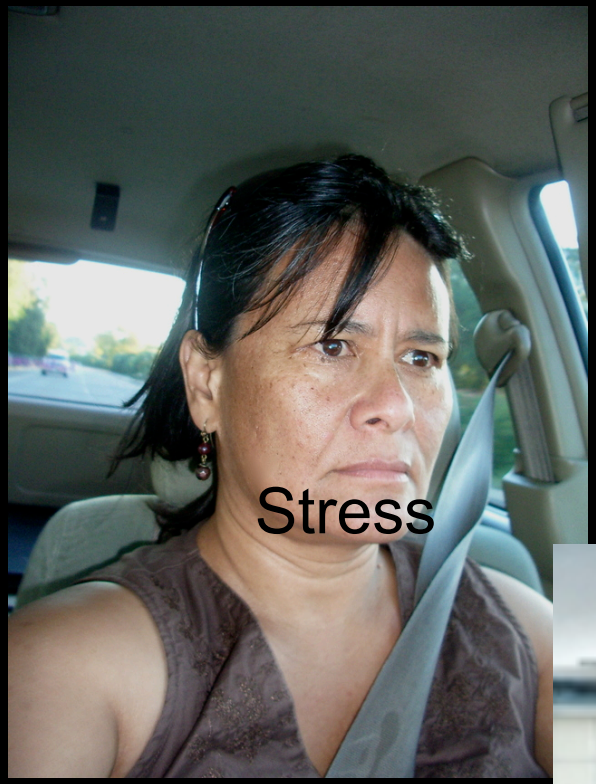
- Chairman Clinical Advisory Board for Medotech A/S 2008-2012

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



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 circardian manifestations: it can occur during sleep (sleep bruxism) or during wakefulness (awake bruxism)*

Lobbezoo et al. JOR 2012

Diagnostic grading of bruxism

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

Lobbezoo et al. 2012

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

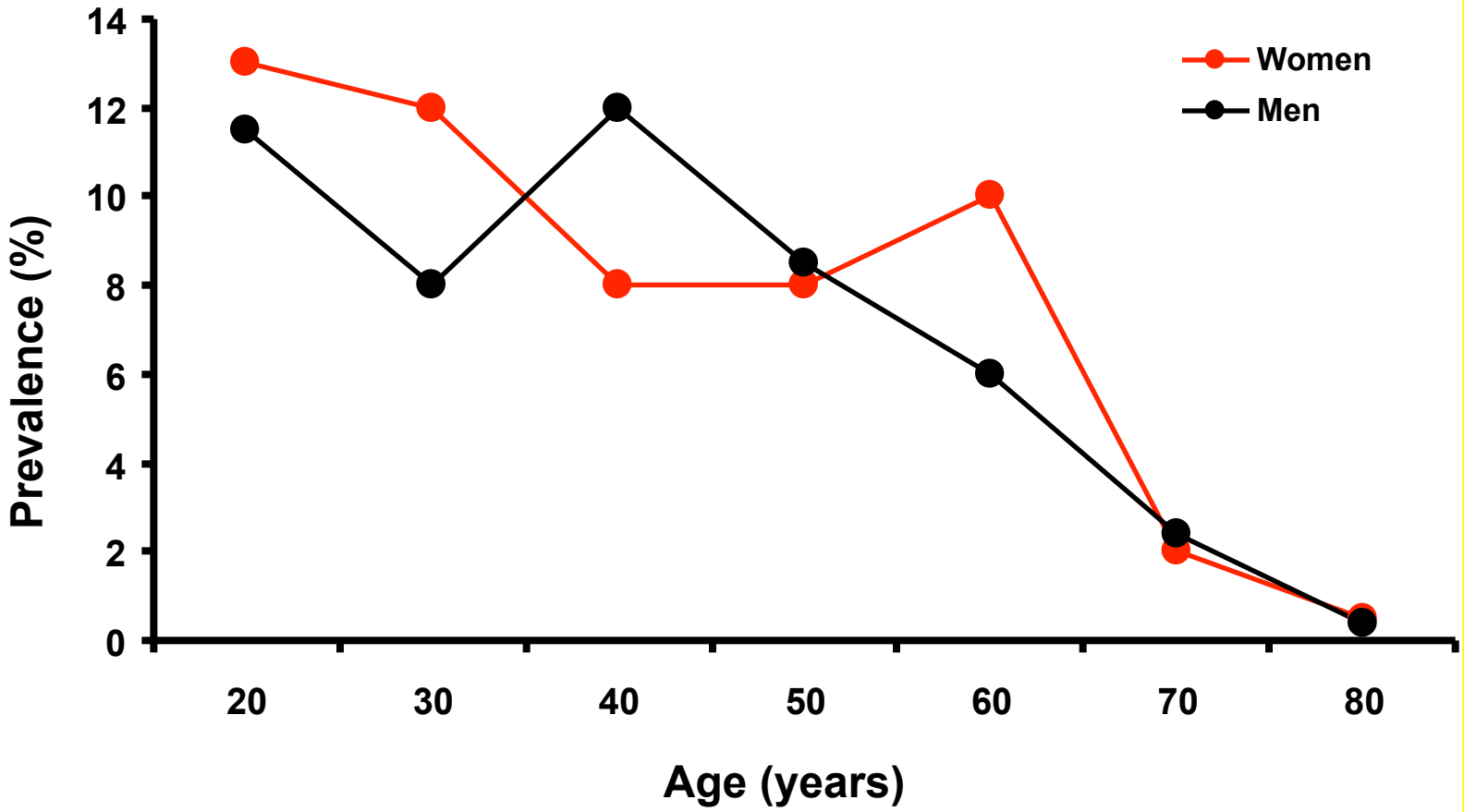
- Awake bruxism
  - Approx. 20%
- Sleep bruxism
  - Approx. 5-8%
    - 14% of children
    - 8% of adults
    - 3% of > 60 years
  - No gender differences

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

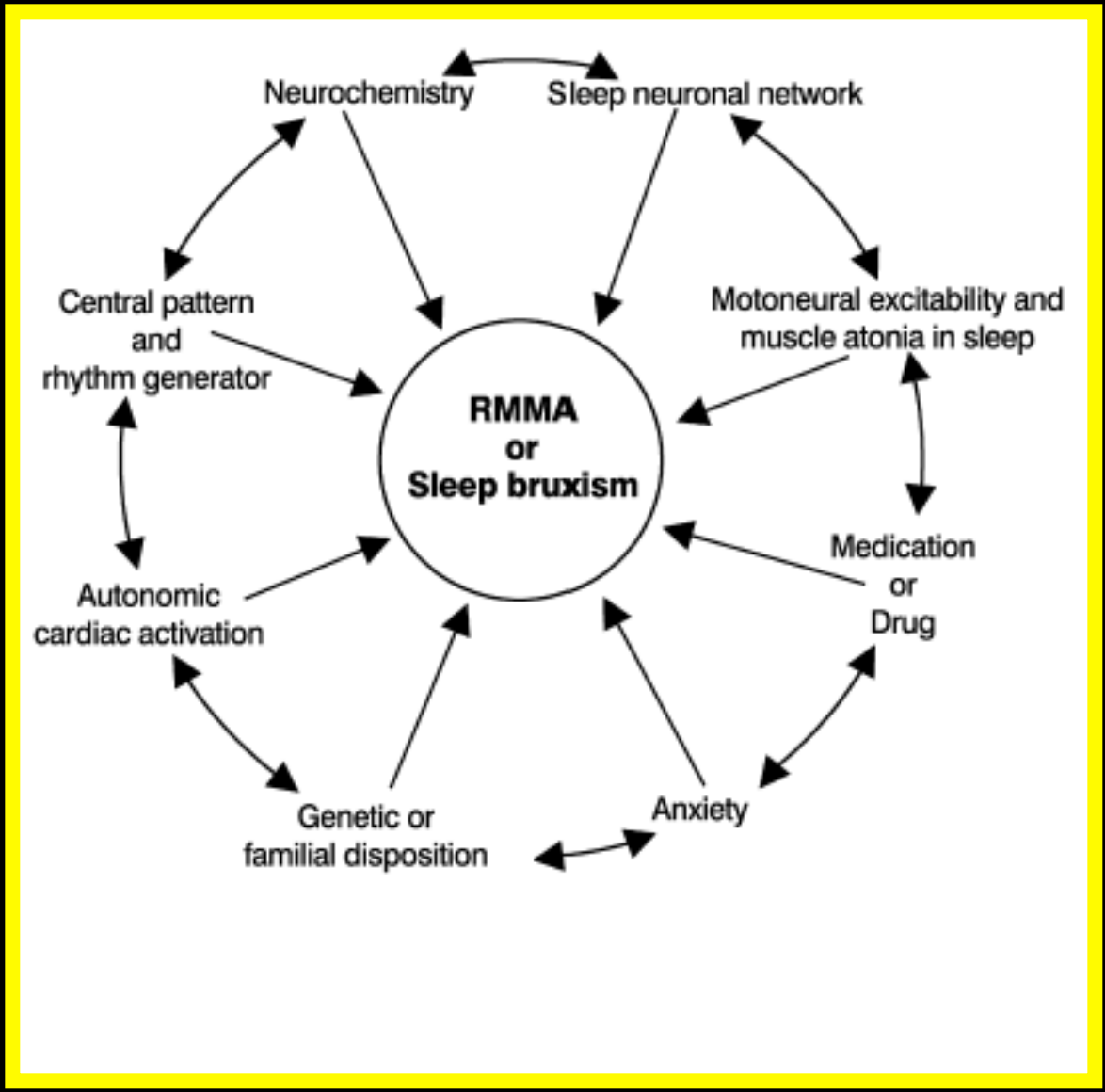
1. Summary

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

Lobbezoo & Lavigne 1997
Lavigne et al. 2008

2. Why do we brux ?

CNS factors

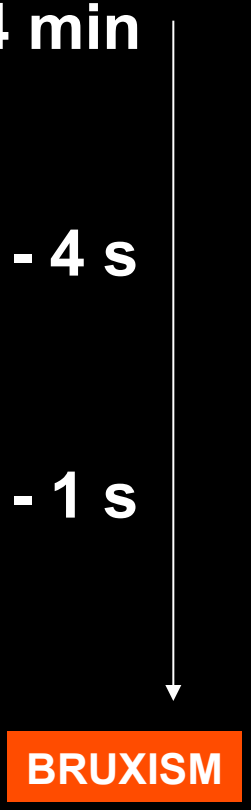


Rhythmic Masticatory Muscle Activity

Lavigne et al. 2003
Lavigne et al. 2008

Pathophysiology of sleep bruxism

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



Importance of autonomic system

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

Mizumori et al. 2013

Macro sleep in sleep bruxers

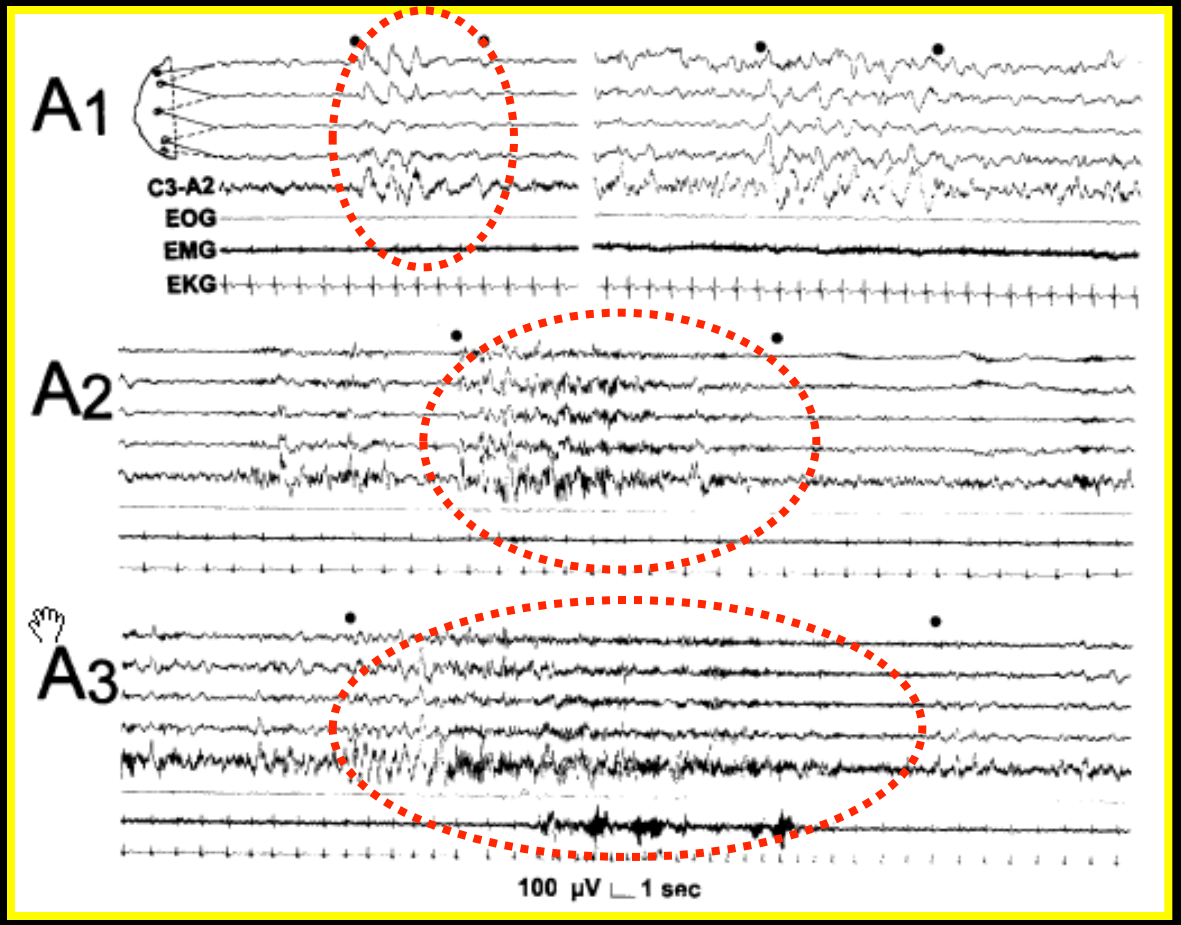
	SB (n=6)	CTR (n=6)	
Total sleep time (min)	430 ± 55	454 ± 40	ns
Sleep latency (min)	19 ± 11	18 ± 16	ns
Wake after sleep onset	26 ± 20	9 ± 12	ns
Stage 1 (min)	29 ± 16	14 ± 10	ns
Stage 2 (min)	226 ± 36	237 ± 45	ns
Stage 3 + 4 (min)	98 ± 16	91 ± 16	ns
Non-REM (min)	353 ± 34	342 ± 44	ns
REM sleep (min)	76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

Macaluso et al. 1998

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

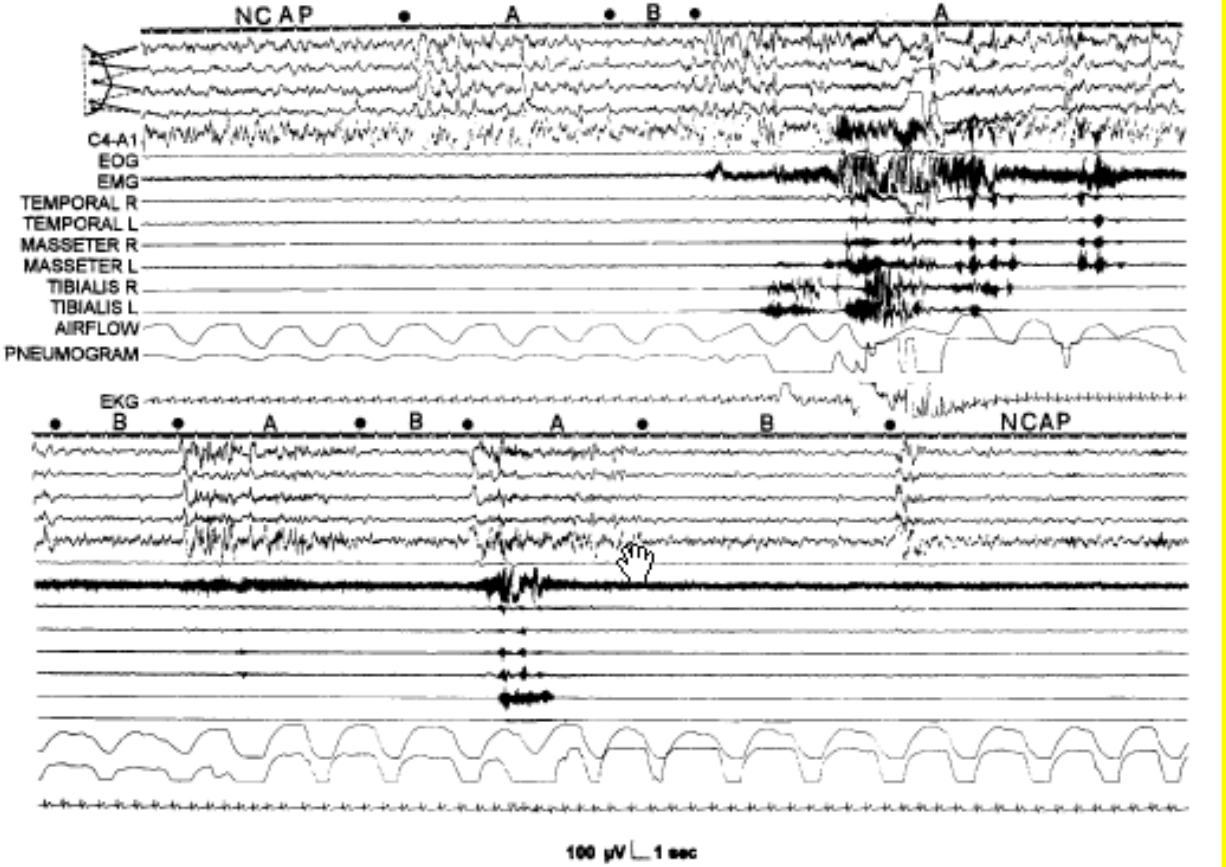
Macaluso et al. 1998

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*

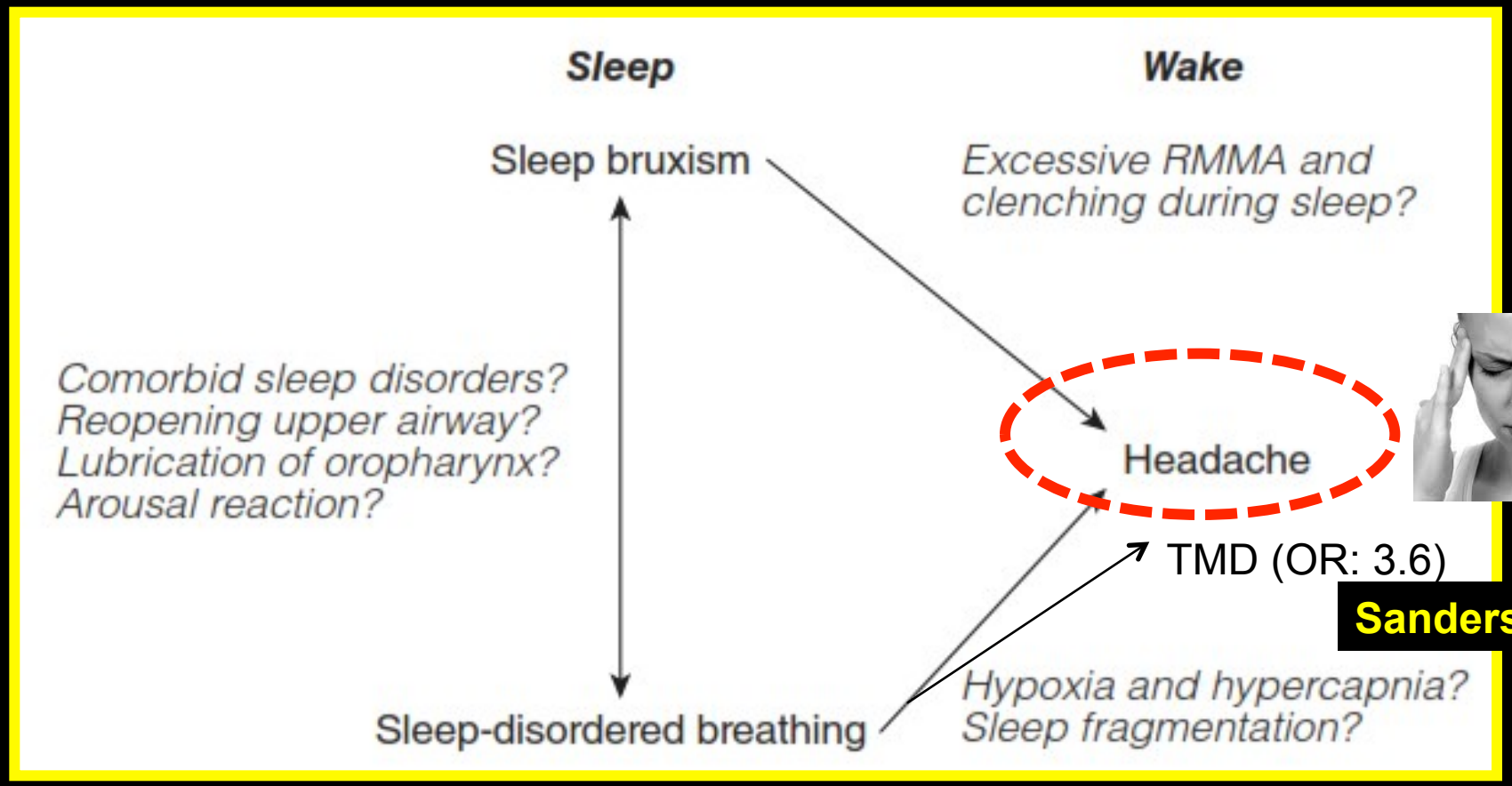
* P < 0.0001 (Chi-square)

Macaluso et al. 1998

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



Carra et al JOP 2012

But what about occlusion and bruxism ?

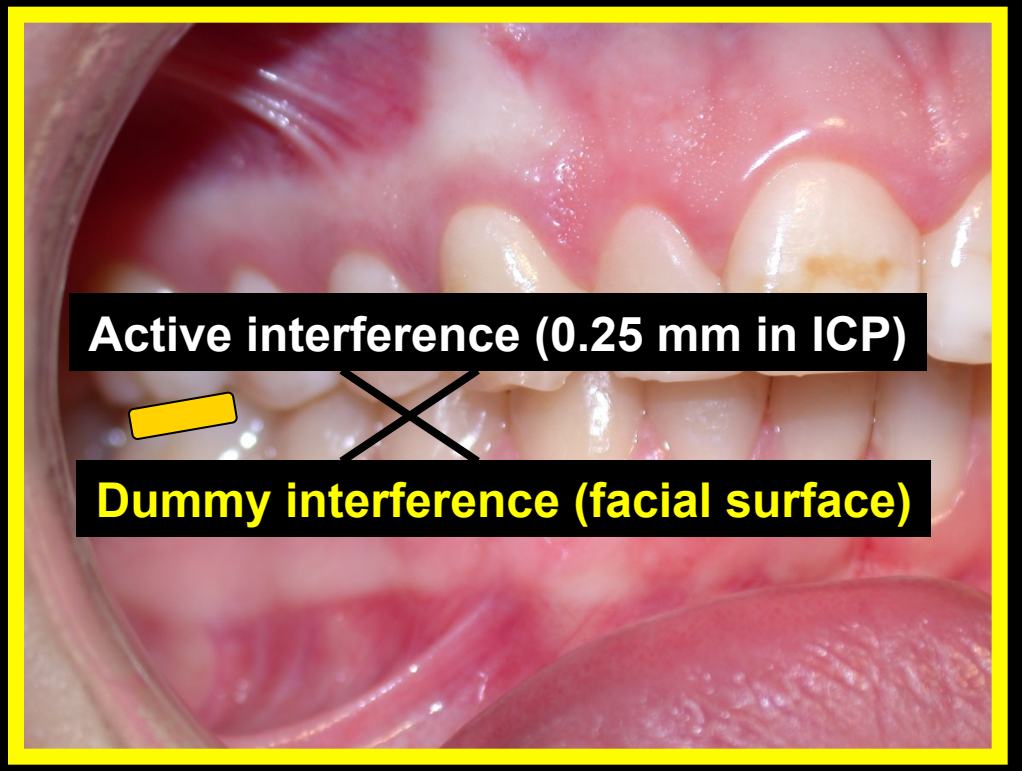
Occlusion and bruxism

- "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 !

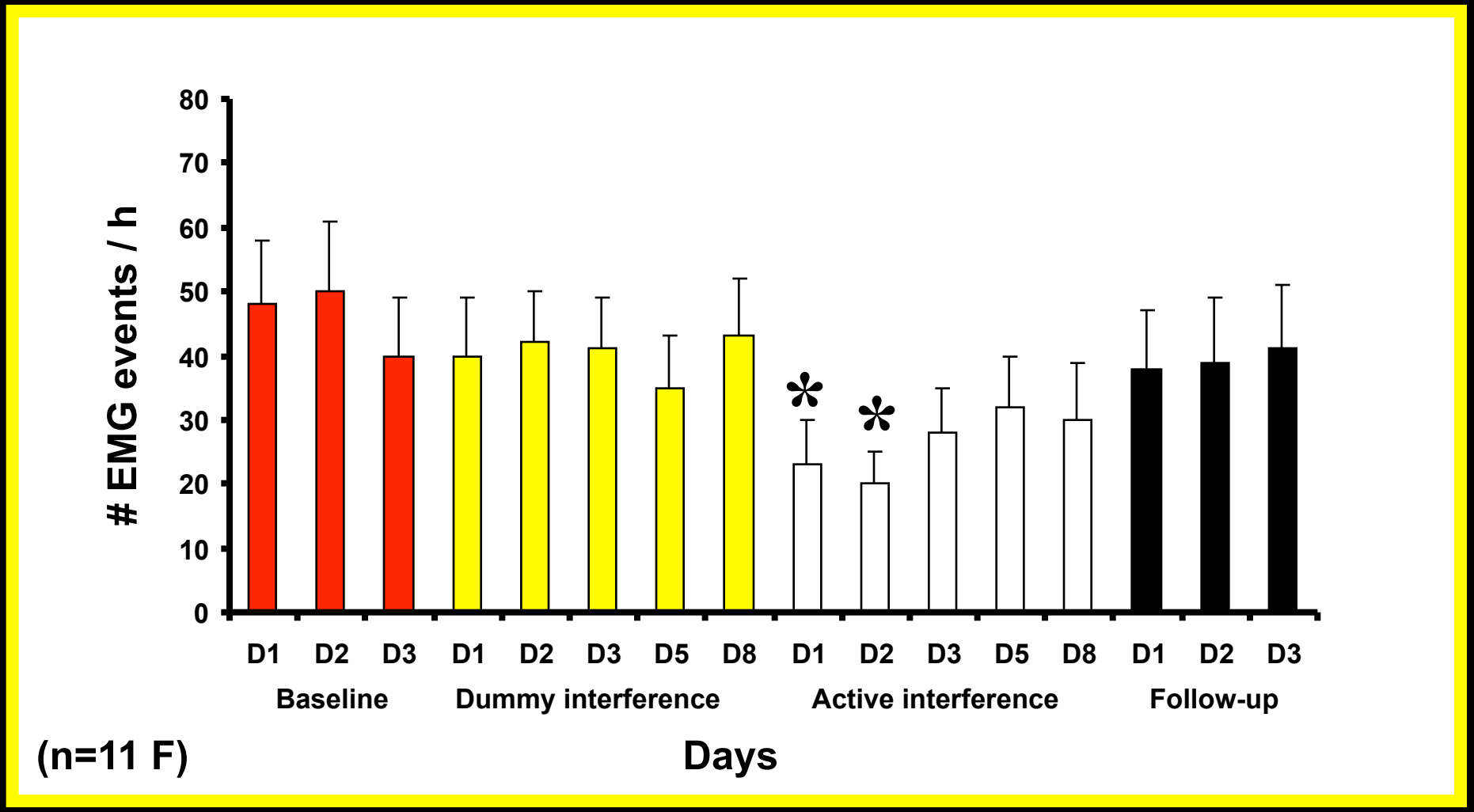
Ramfjord 1961

Human experimental study



Michelotti et al. 2005

Influence of occlusal interferences



Michelotti et al. 2005

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

Lobbezoo et al. 2001

Importance of occlusion for bruxism

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

Lobbezoo et al. JOR 2011

2. Summary

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

Lobbezoo et al. 2008
Lavigne et al. 2008
Svensson and Lavigne 2011

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

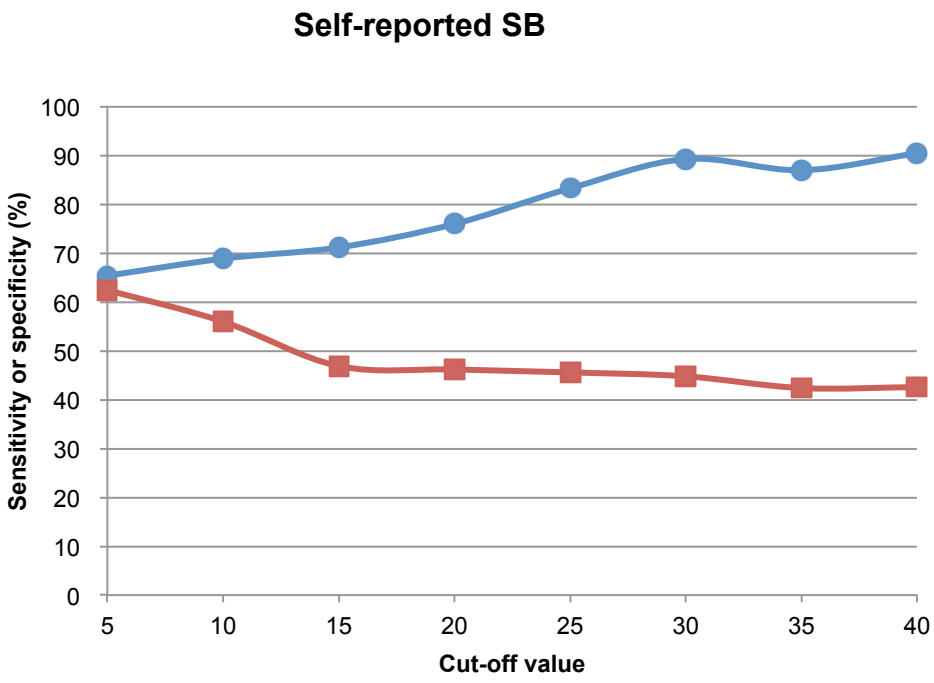
BUT

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

(n = 87)

Raphael et al. 2012

Self-reports of bruxism



Grinds / h sleep

N=115

Yachida et al. 2013 (in progress)

Clinical examination

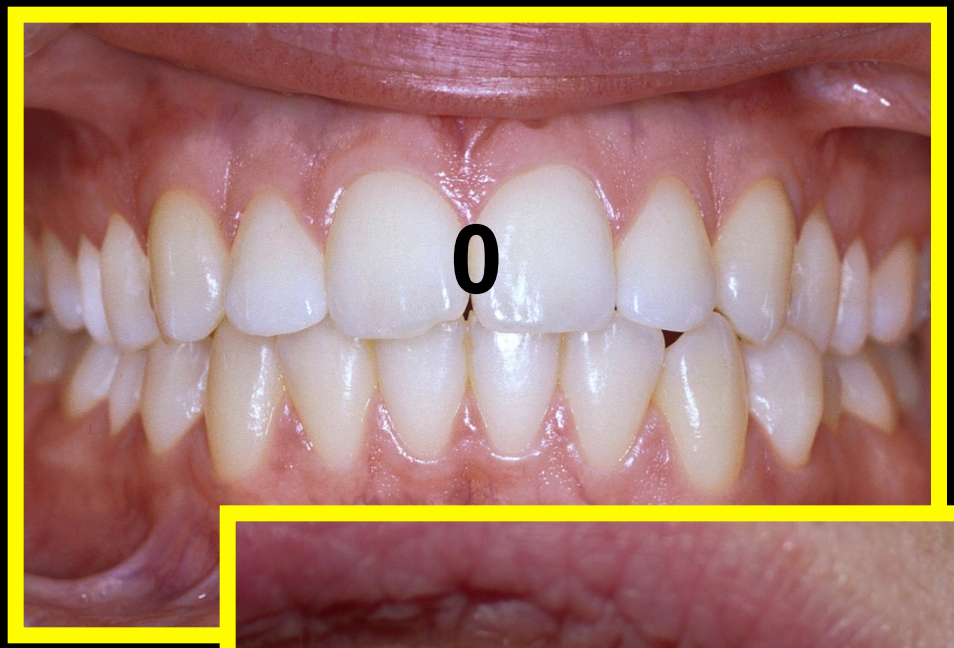
- Intraoral
  - Hyperkeratosis
  - Tongue scalloping
  - Cheek biting

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

Abe et al. 2010

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)

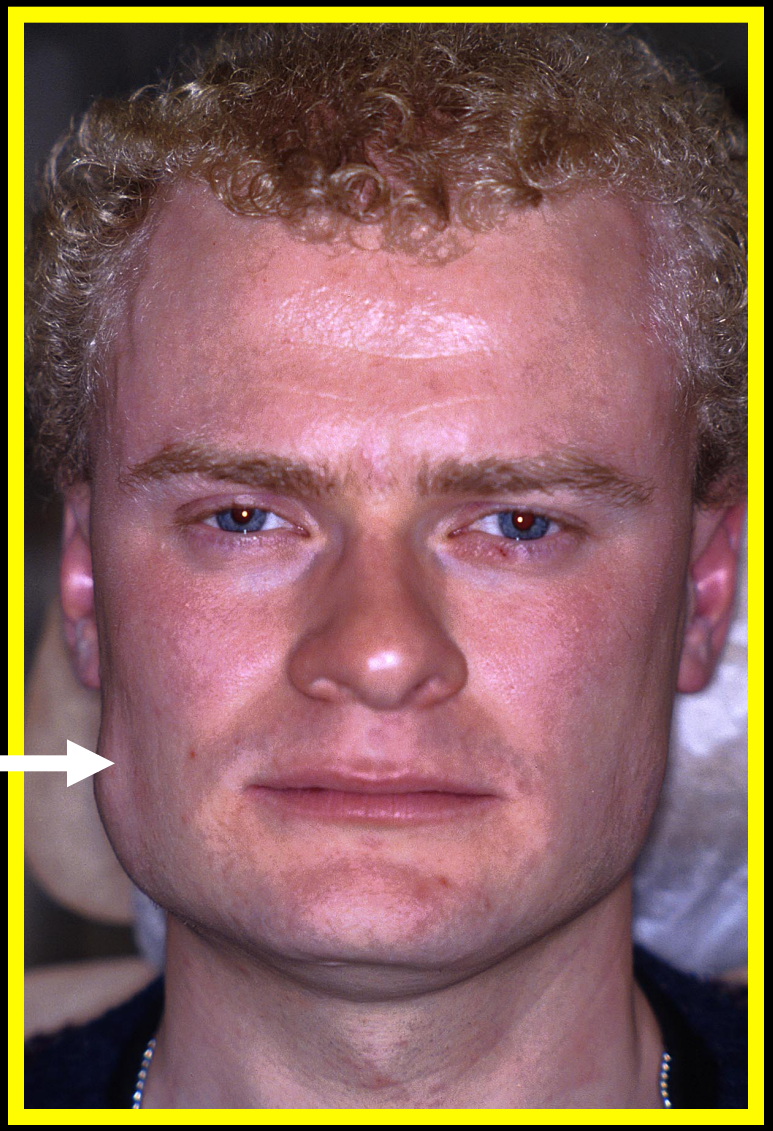
Case 2

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”)

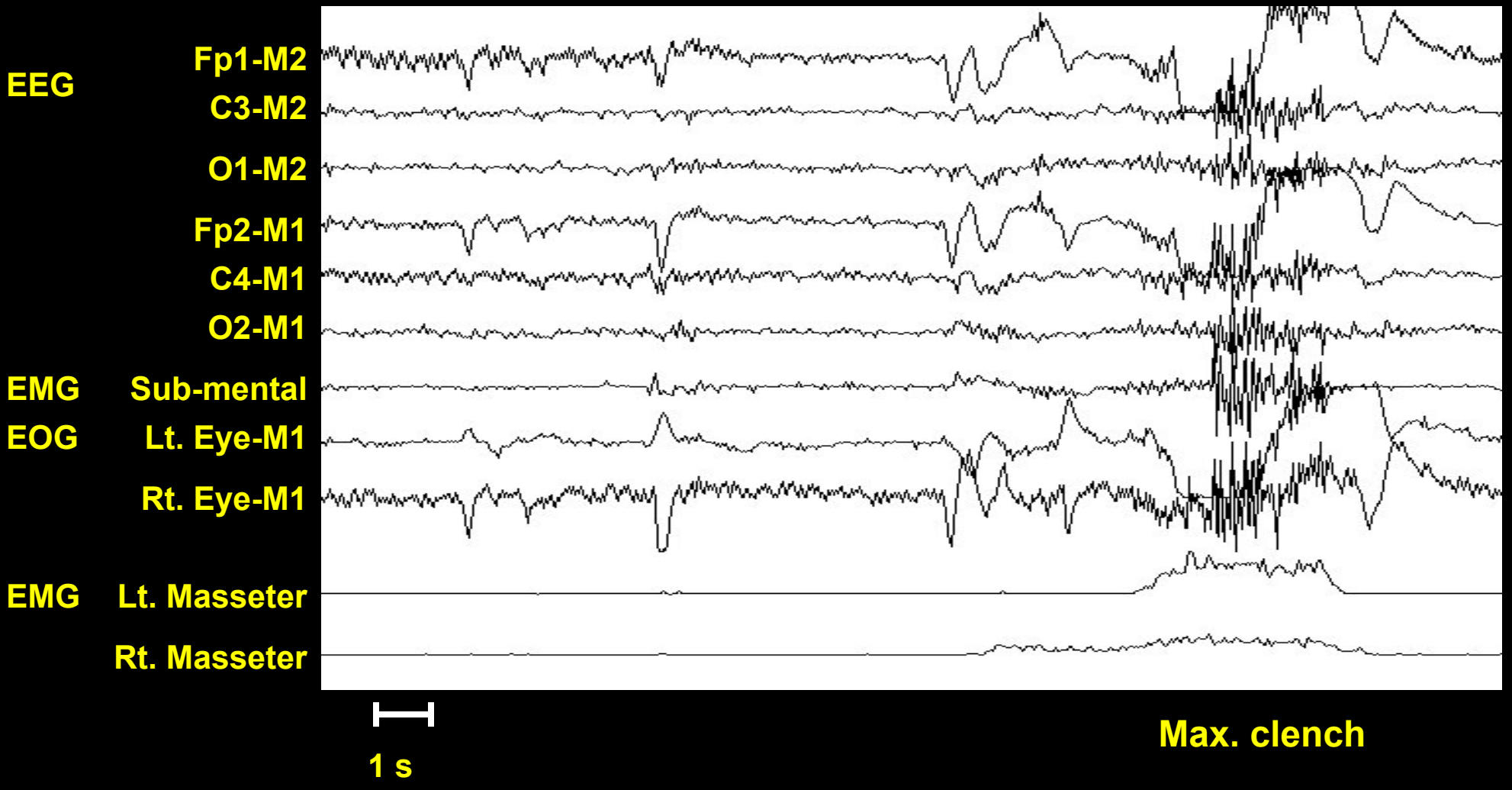
Additional tests

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

Polysomnography

Arima et al. 2001

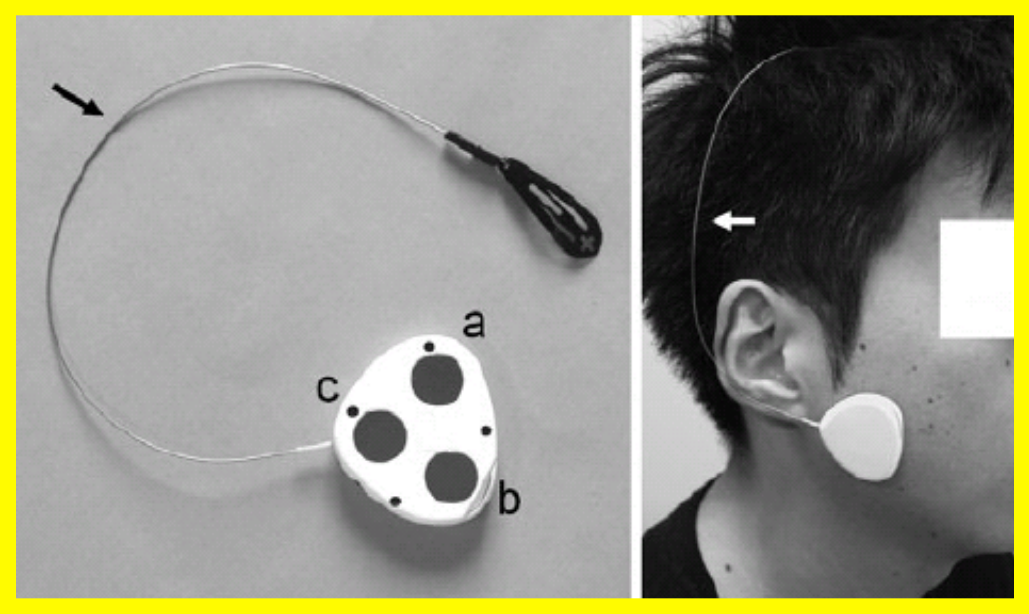
Example

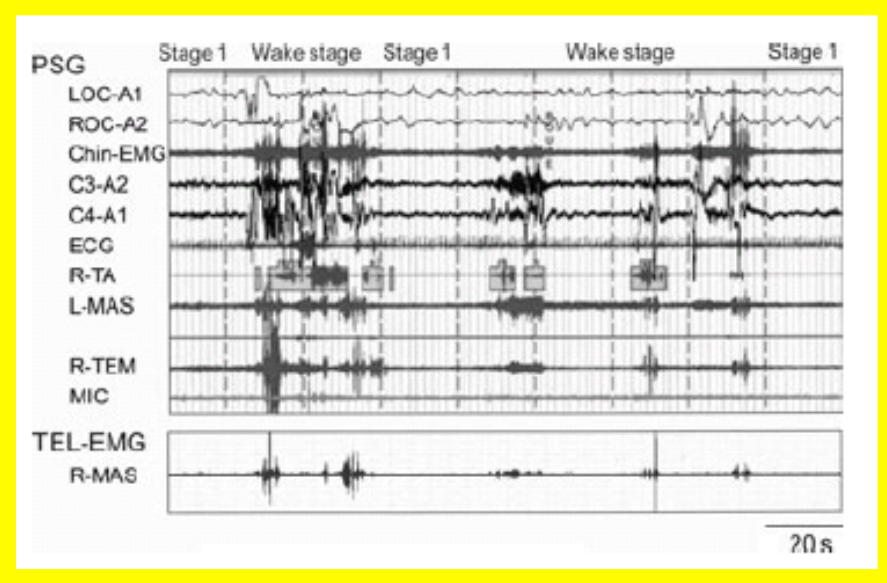


Arima et al. 2001

Single channel EMG devices

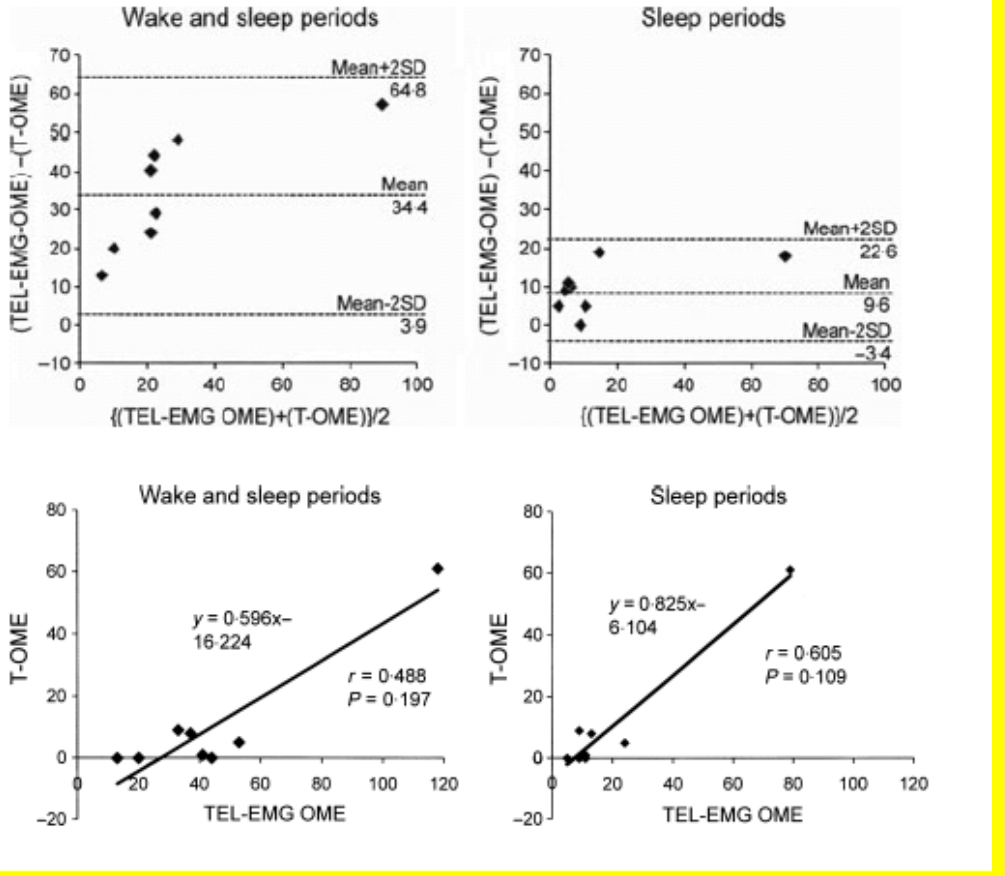
Single channel EMG vs PSG

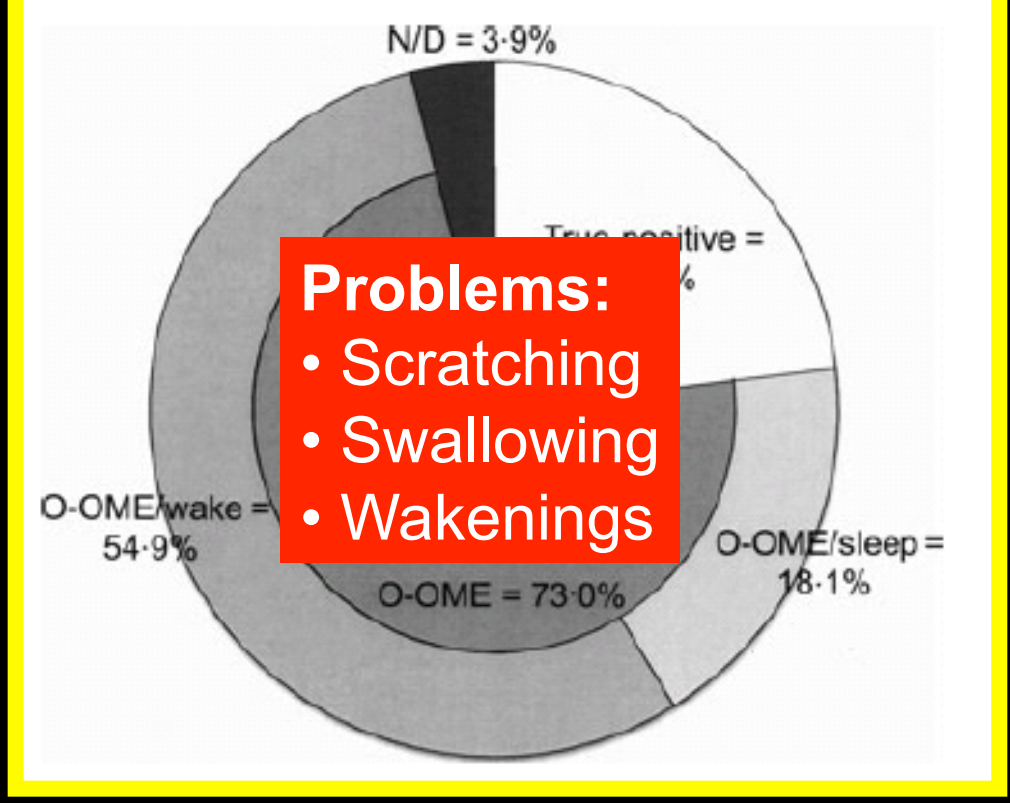




Yamaguchi et al. 2011

Single channel EMG vs PSG





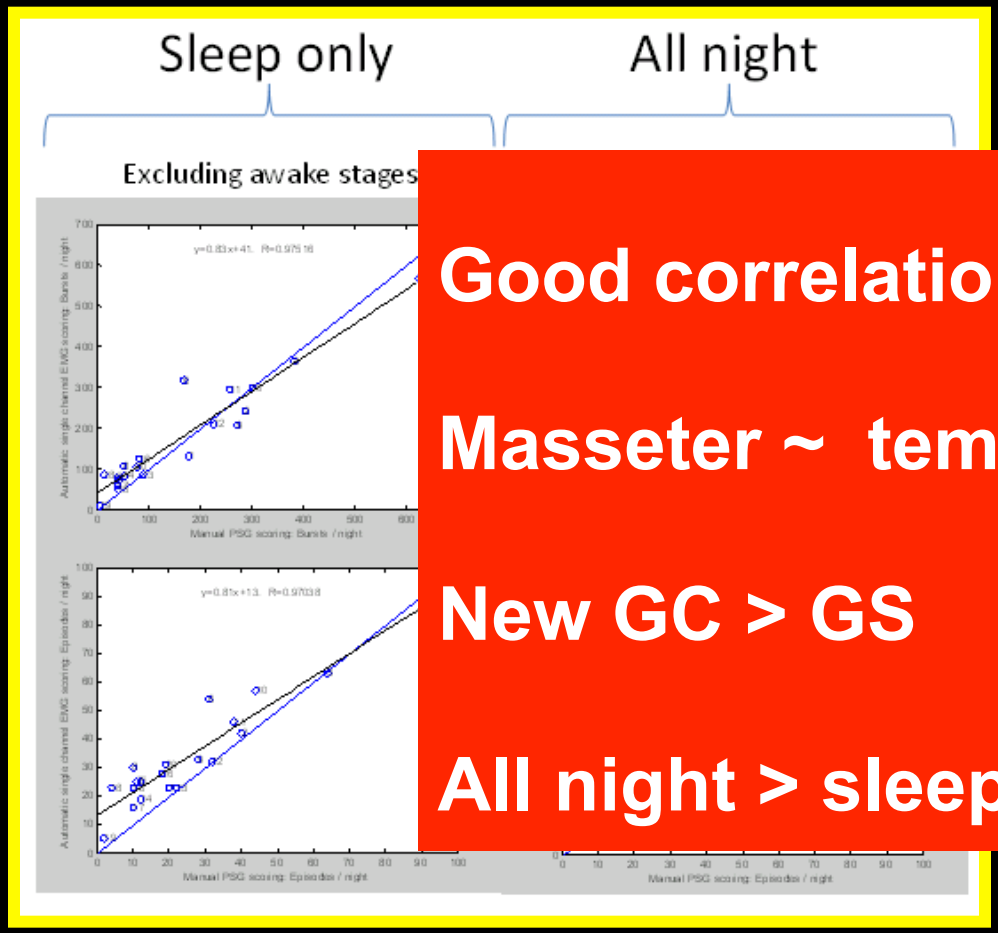
N = 8

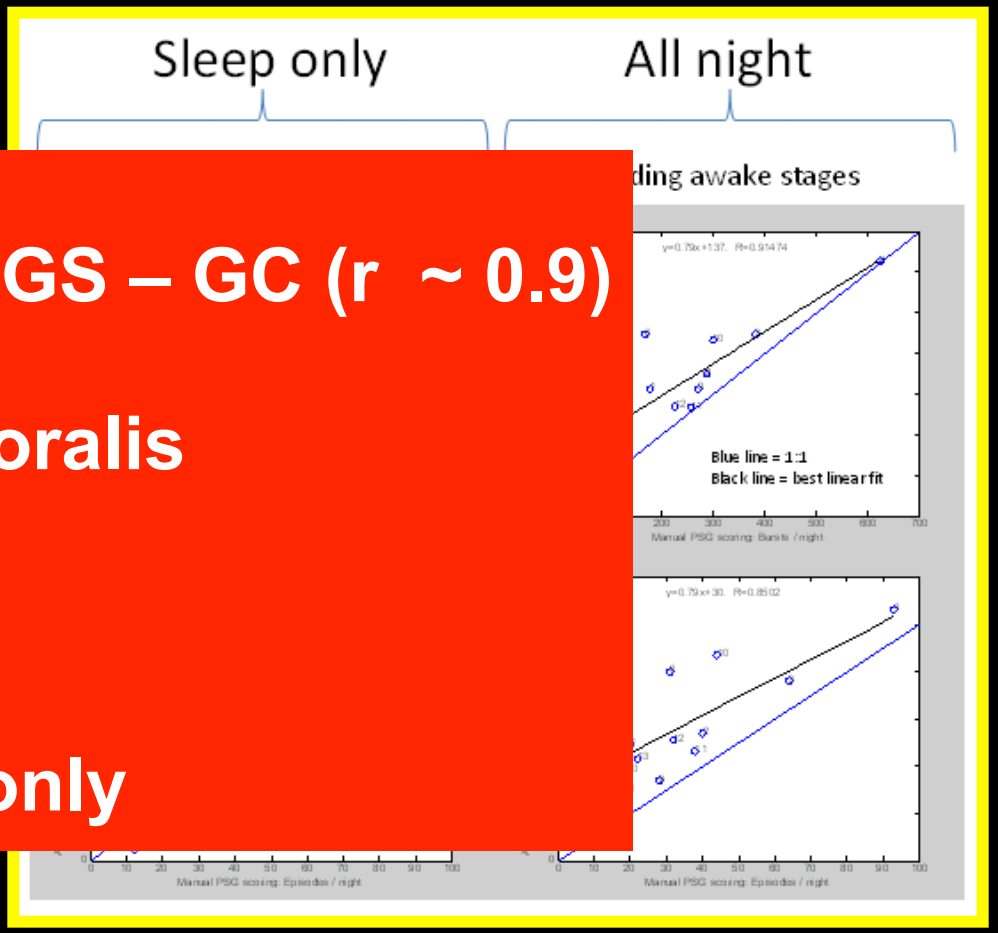
Yamaguchi et al. 2011

Single channel EMG device

Grindcare version3®

Correlation between ”gold standard” and new GC algorithm





Good correlation GS – GC (r ~ 0.9)

Masseter ~ temporalis

New GC > GS

All night > sleep only

(n=20)

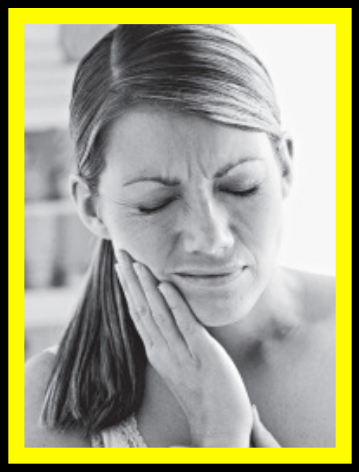
Haugland et al. – in progress - 2013

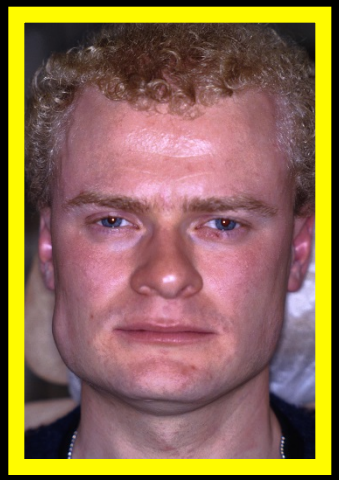
3. Summary

- 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 hypertrophia
- 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)

Manfredini et al. 2012

Bruxism and TMD pain

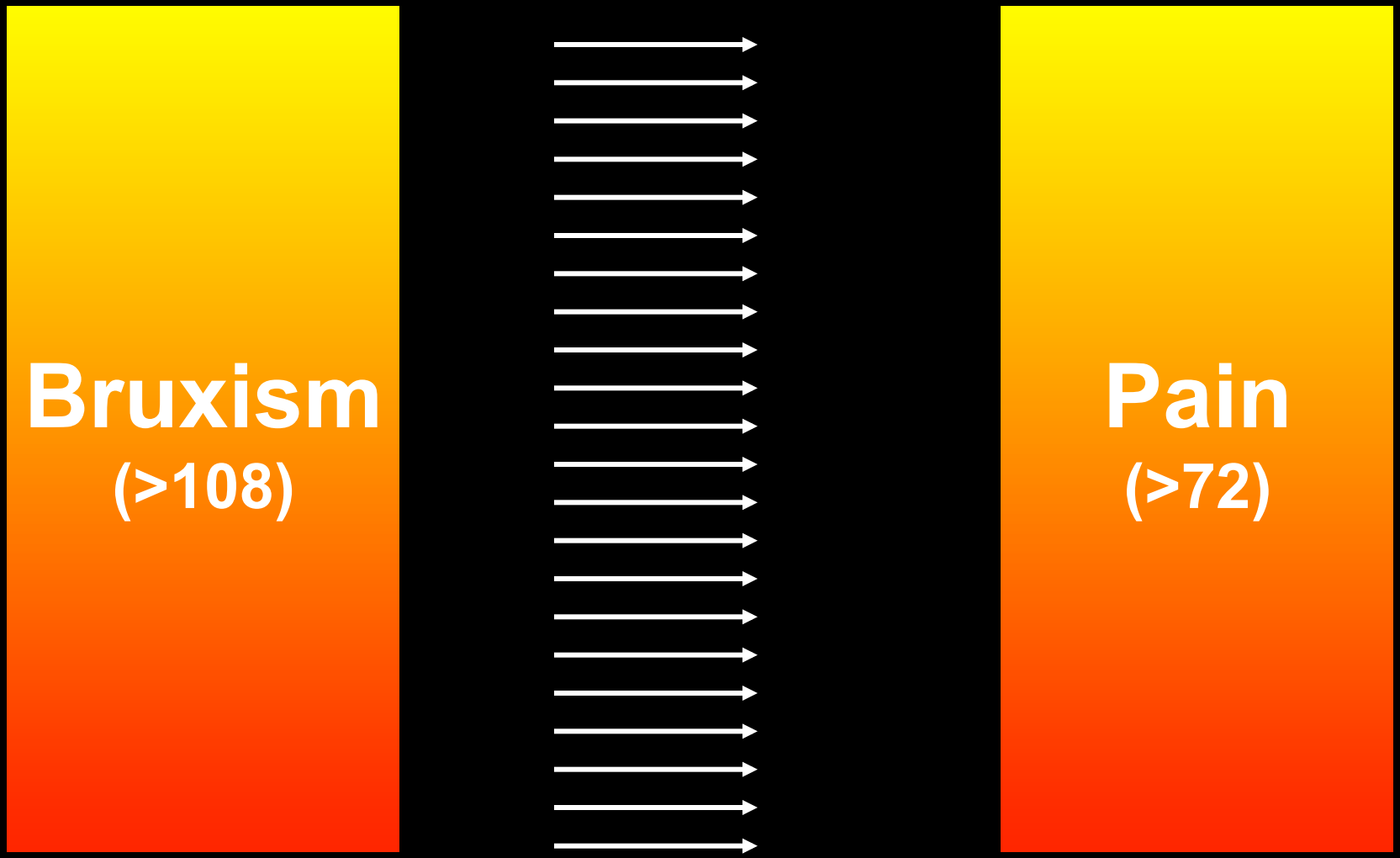
Multiple types of TMD pain

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

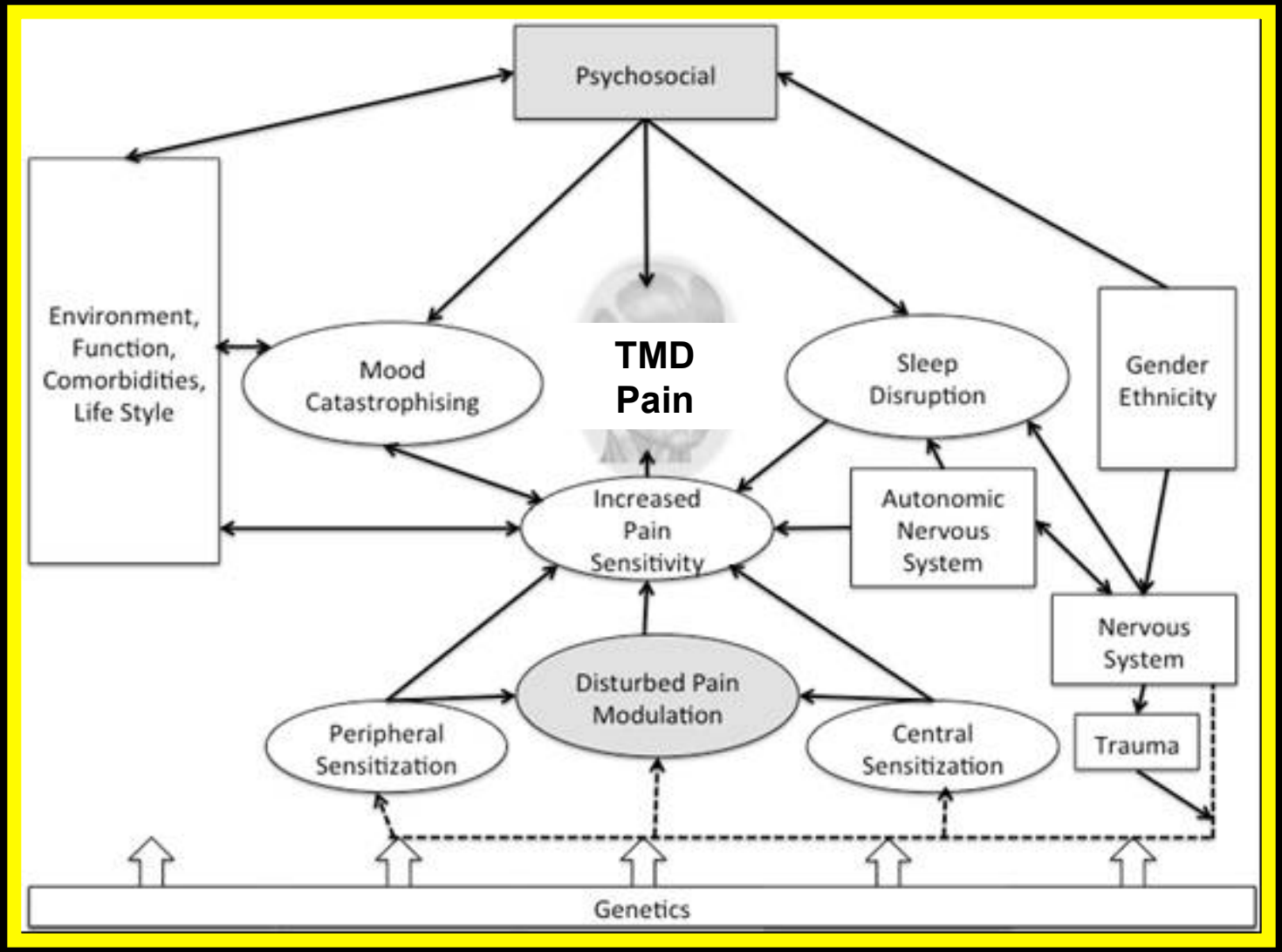
>> 4 x 2 x 3 x 3 = 72 different types of pain

e.g. Inflammatory – acute – low - frequent

Very complex relationships

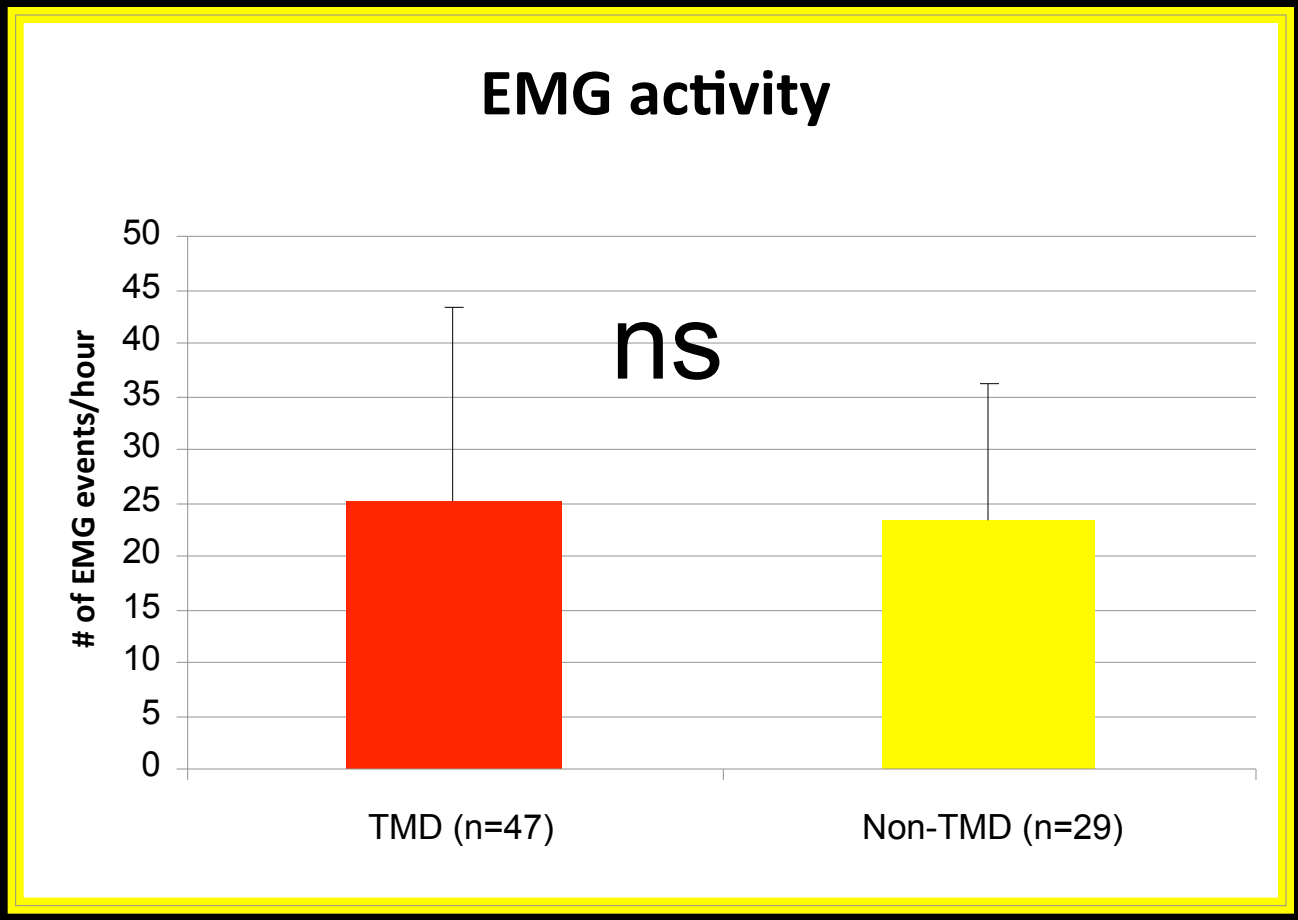


Complex TMD pain model



Benoliel, Svensson, Eliav 2012

EMG activity in TMD patients



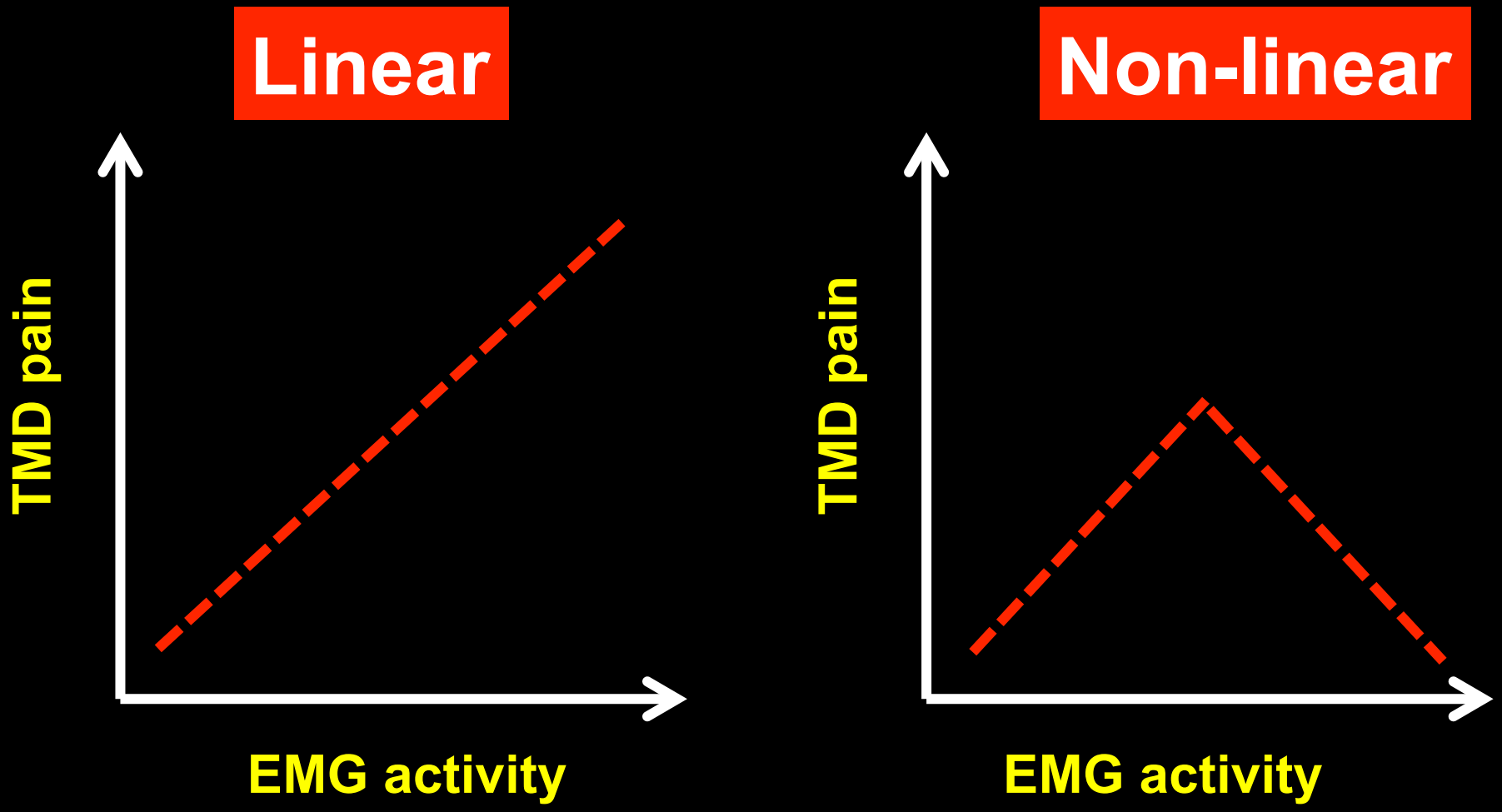
Yacida et al. 2012

4. Summary

~~Bruxism causes pain~~

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

Relationships

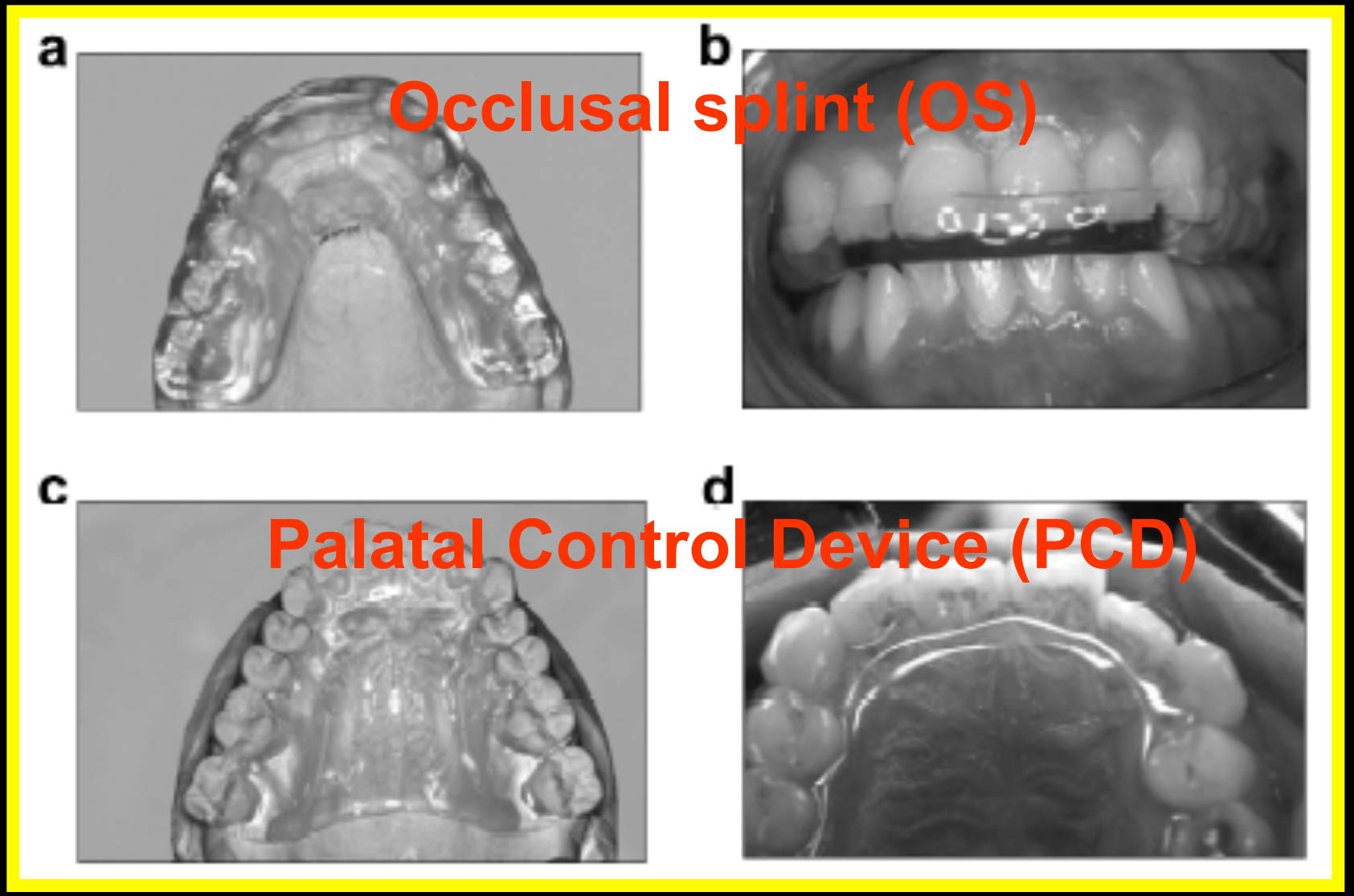


5. Management of bruxism

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

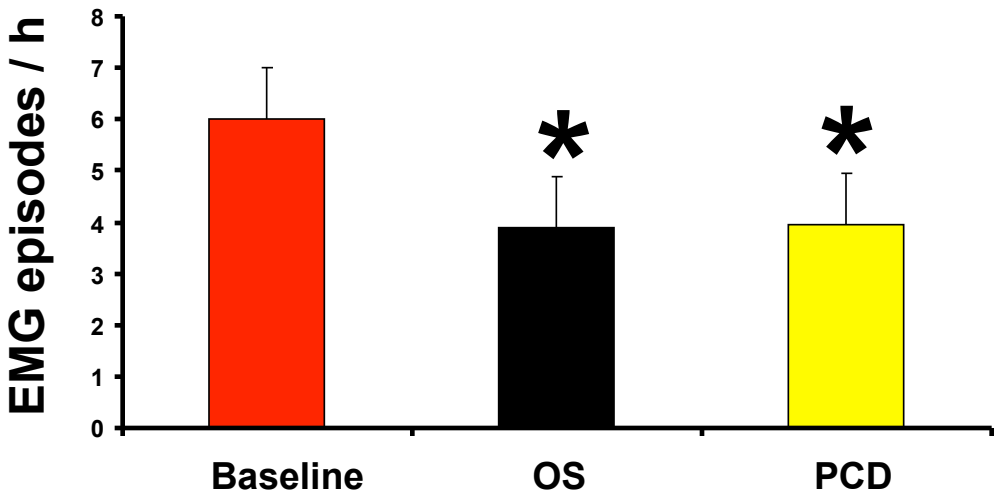
Occlusal splint

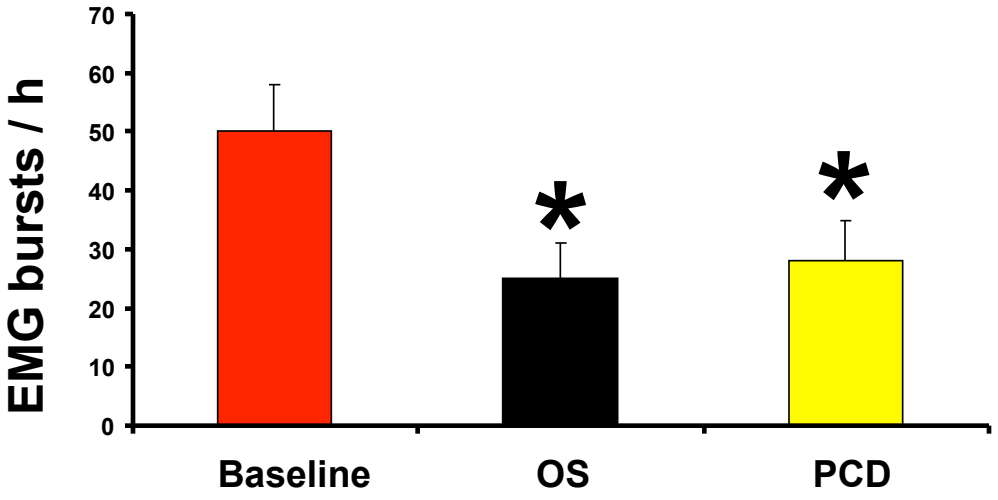
RCT study on sleep bruxism



Dubé et al. 2004

RCT study on sleep bruxism

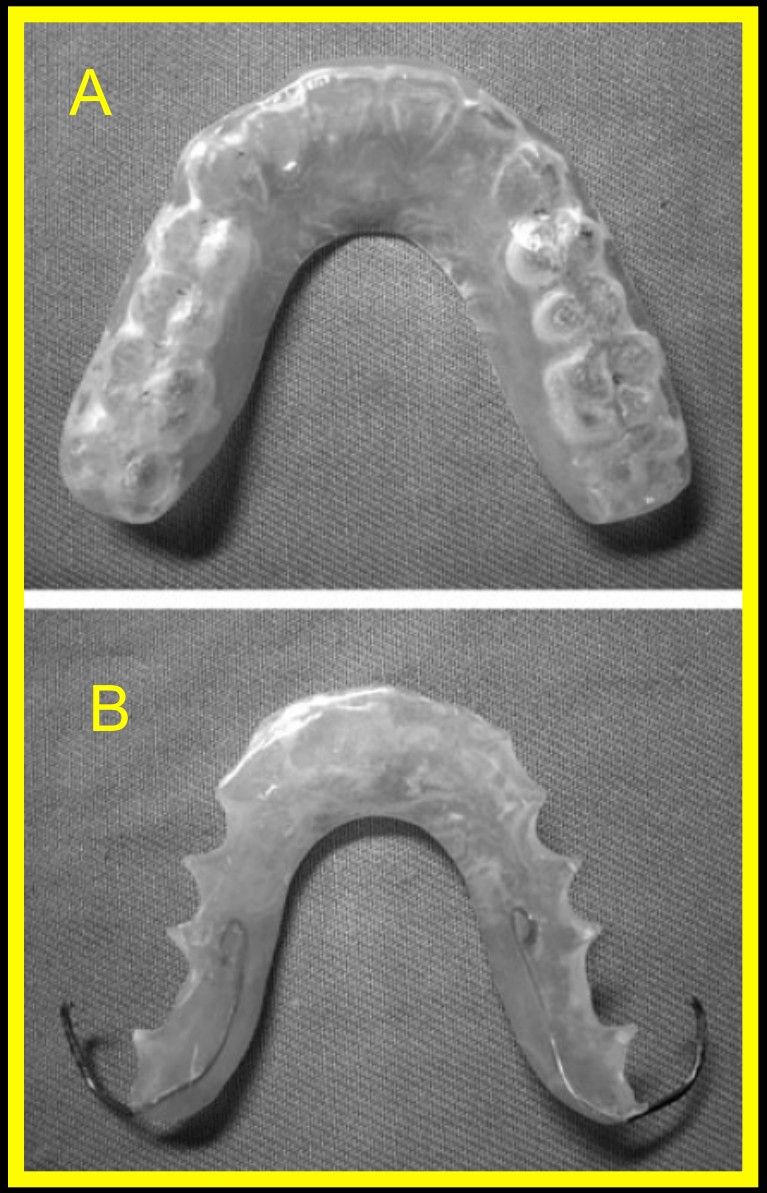


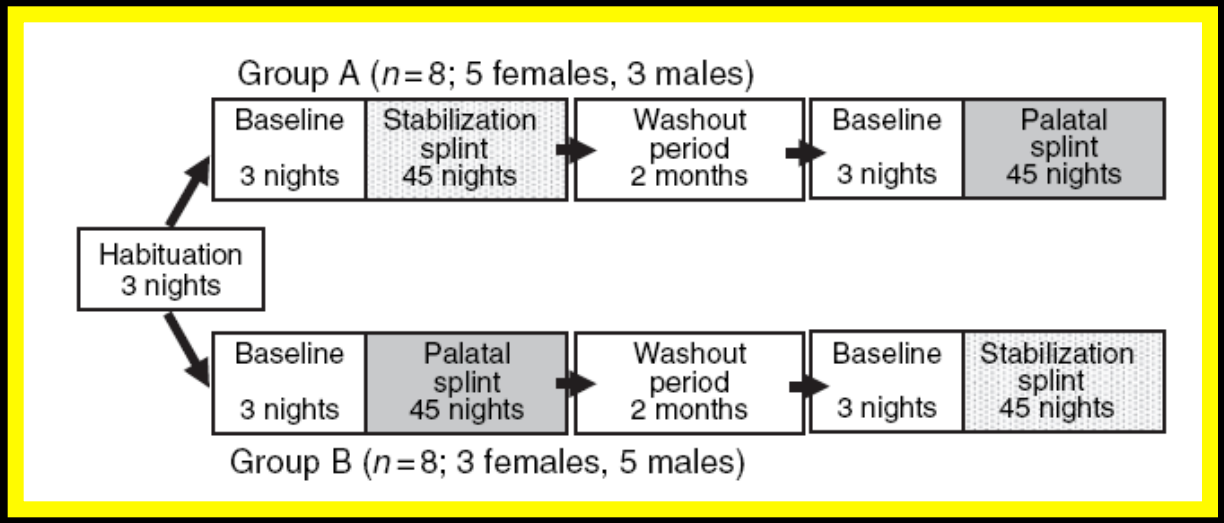


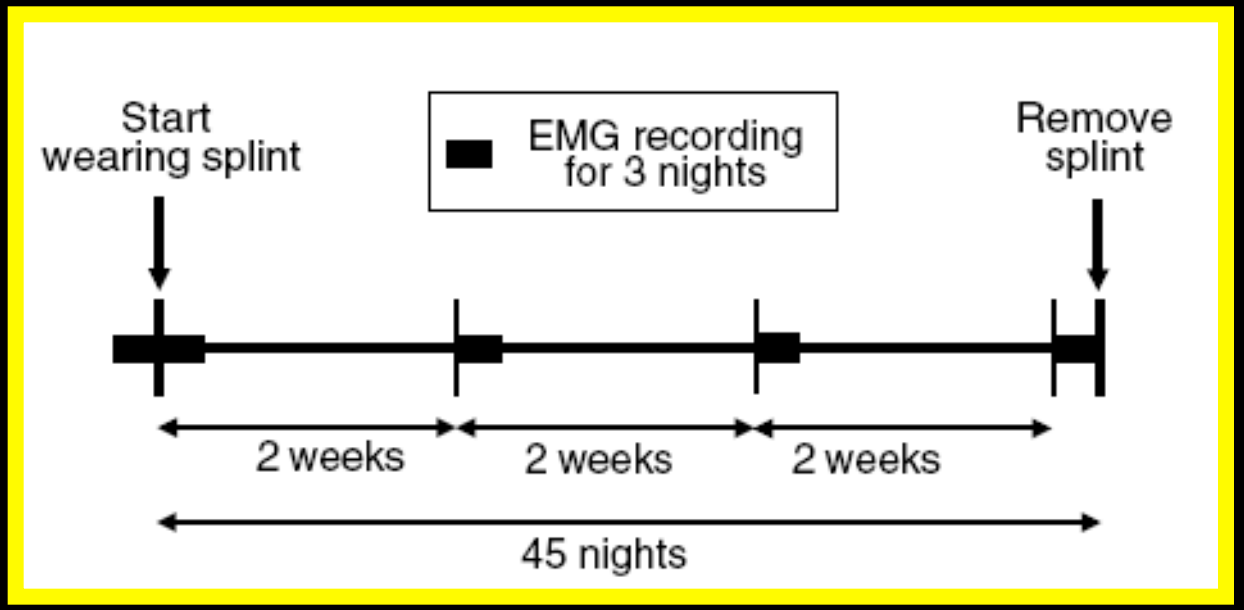
(n = 9)

Dubé et al. 2004

RCT study on long-term effects



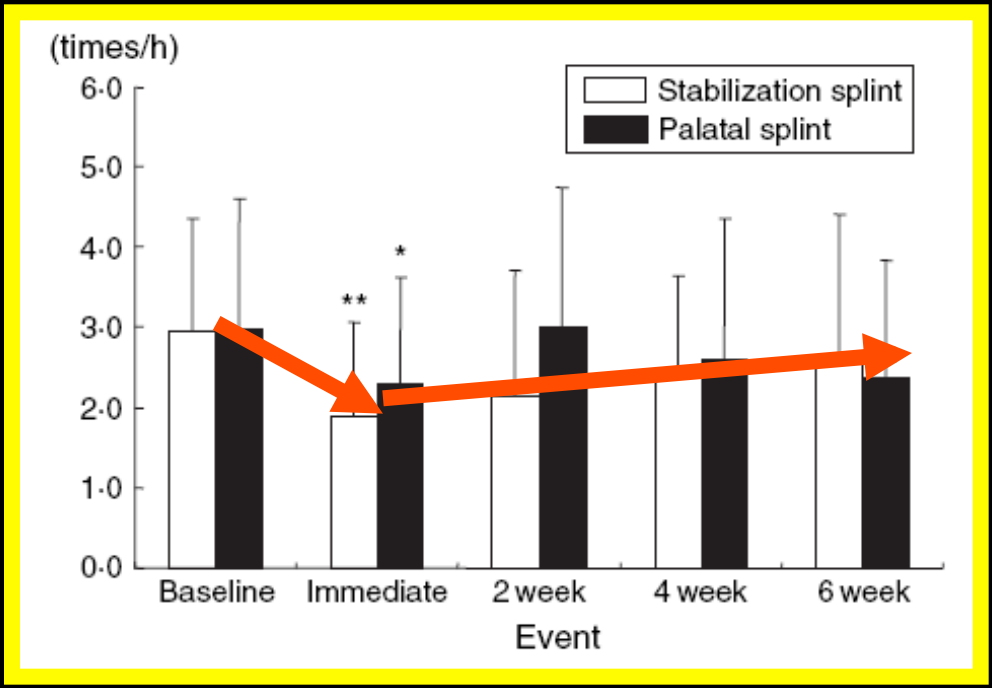


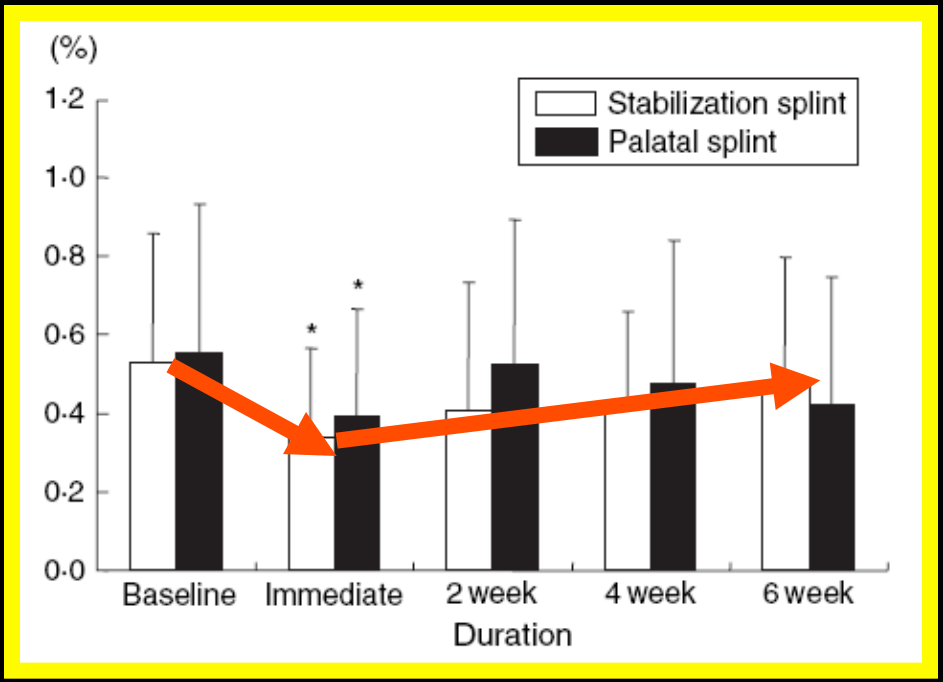


Harada et al. 2006

No long-term effects of splints !

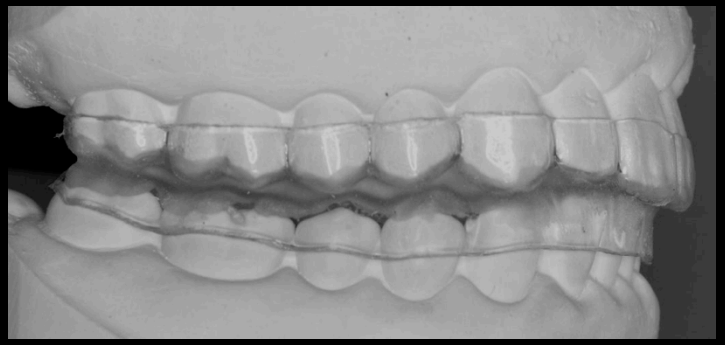
Fits clinical observation of wear on splints
Bruxism continues !



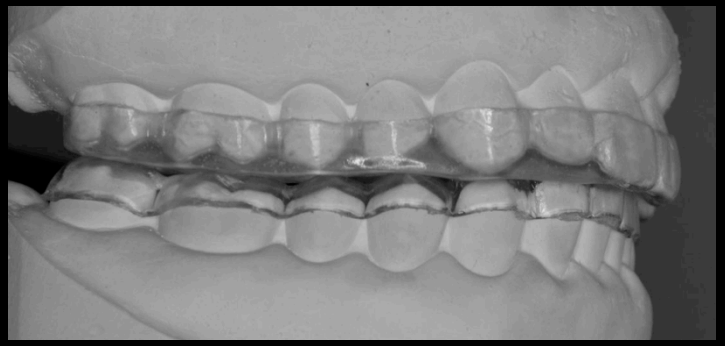


Harada et al. 2006

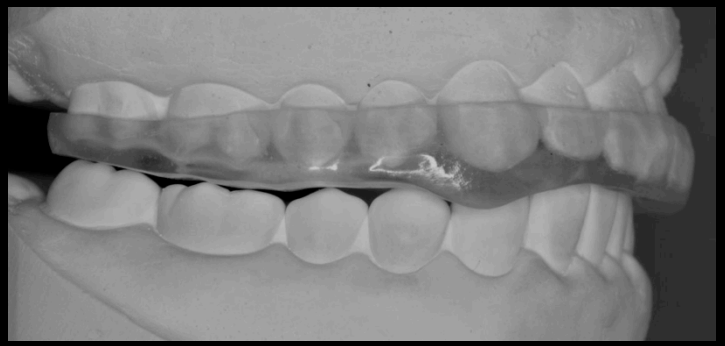
Different types of splints



Restrict Maxillary and Mandibulary Occlusal Appliance



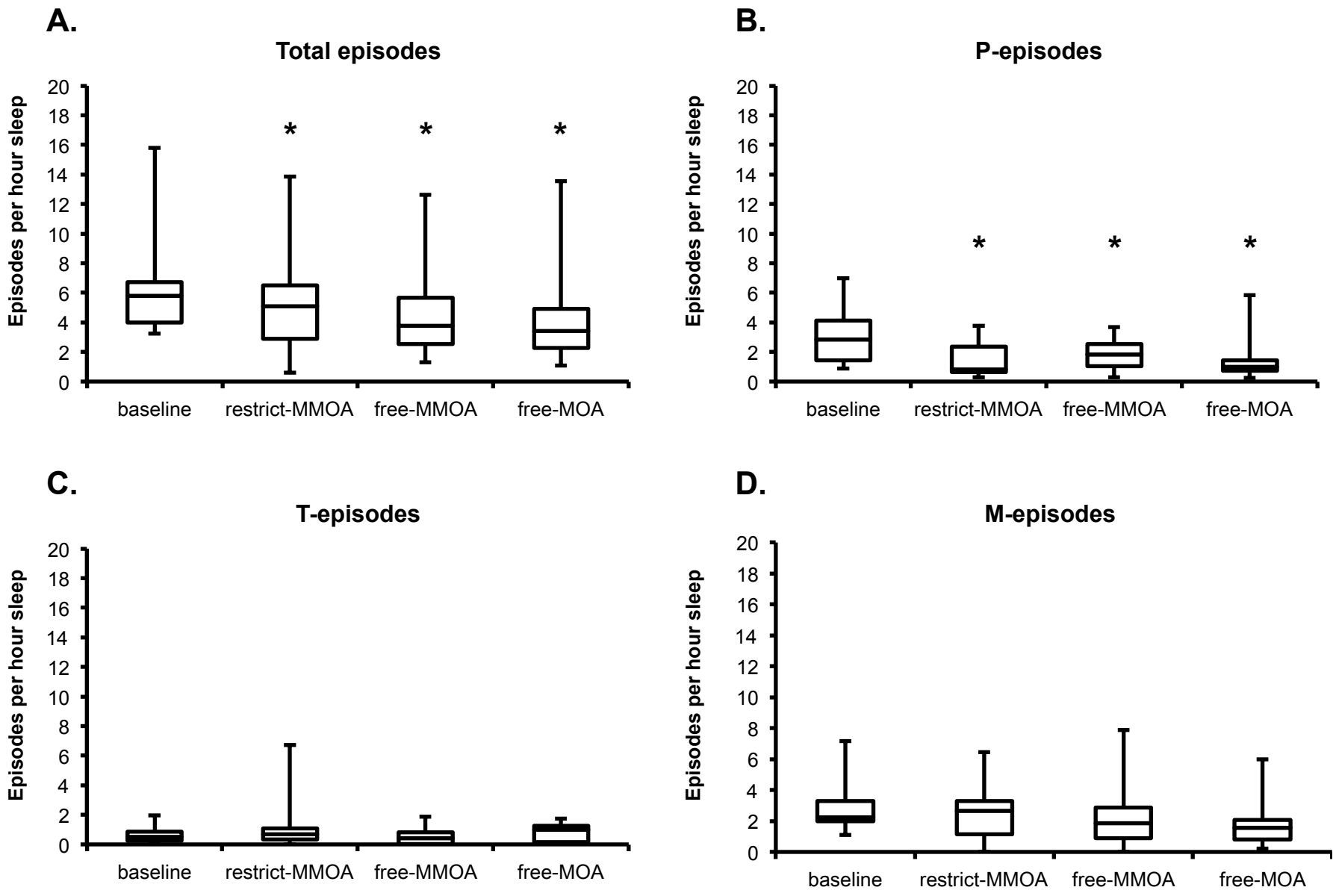
Free Maxillary and Mandibulary Occlusal Appliance



Free Maxillary Occlusal Appliance

Arima et al. 2012

Immediate effects

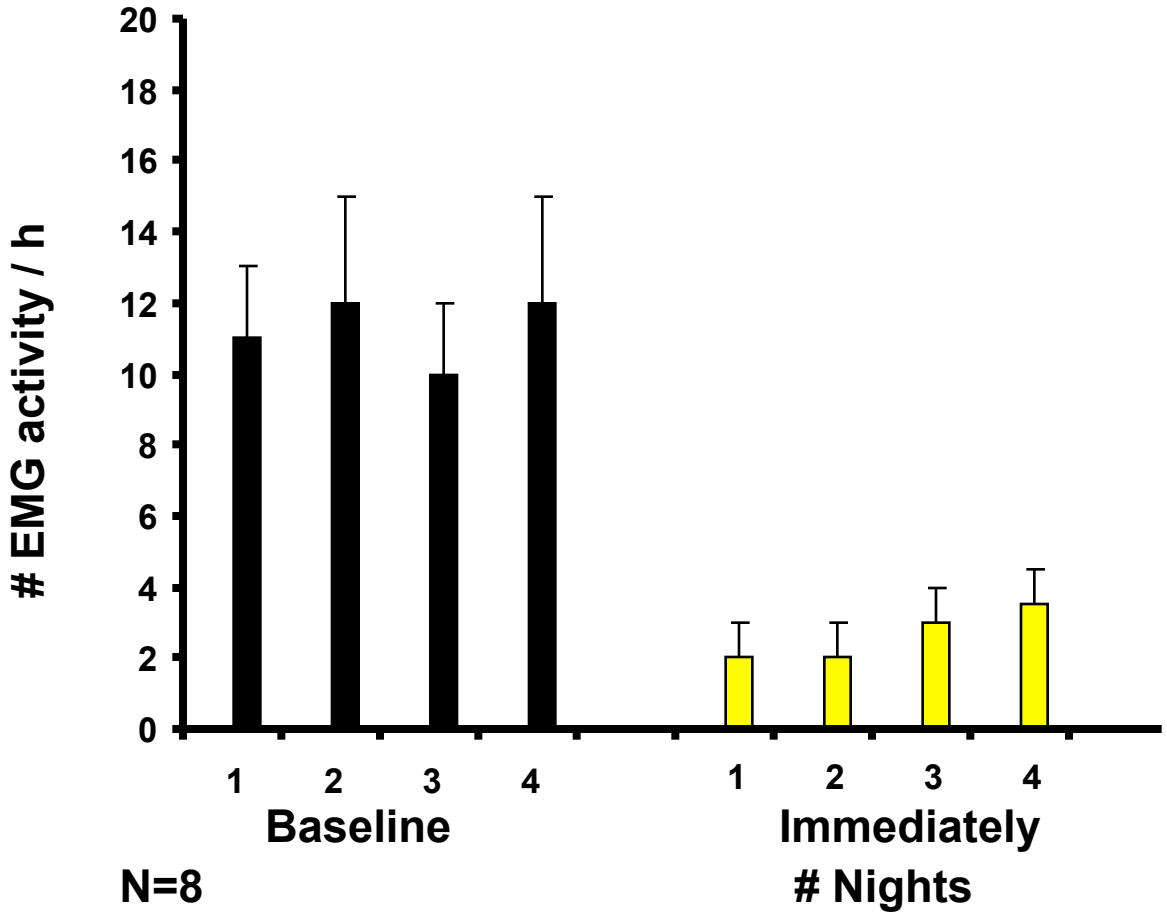


Mandibular advancement device

Decrease in EMG activity by ~ 40%
OBS: Frequent adverse effects with pain in TMJ / muscles

Landry et al. 2006

Effect of MAD on EMG activity



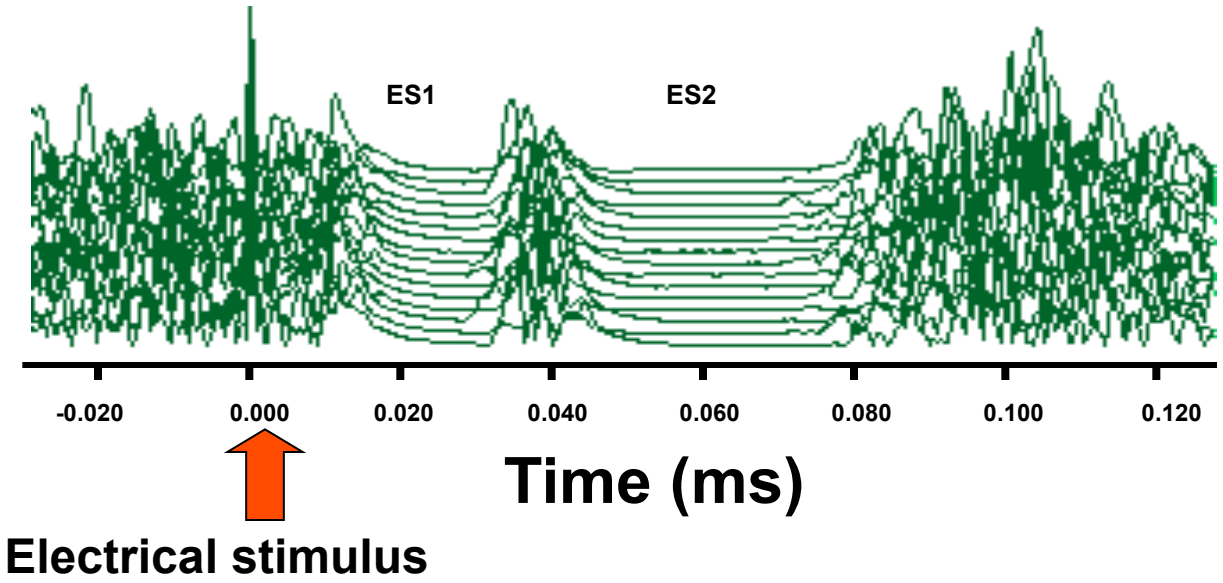
Dagsdottir et al. 2013 – in progress

Portable EMG device + stimulation

Grindcare version3®

Inhibition of EMG activity

Exteroceptive Suppression Reflex (ES)

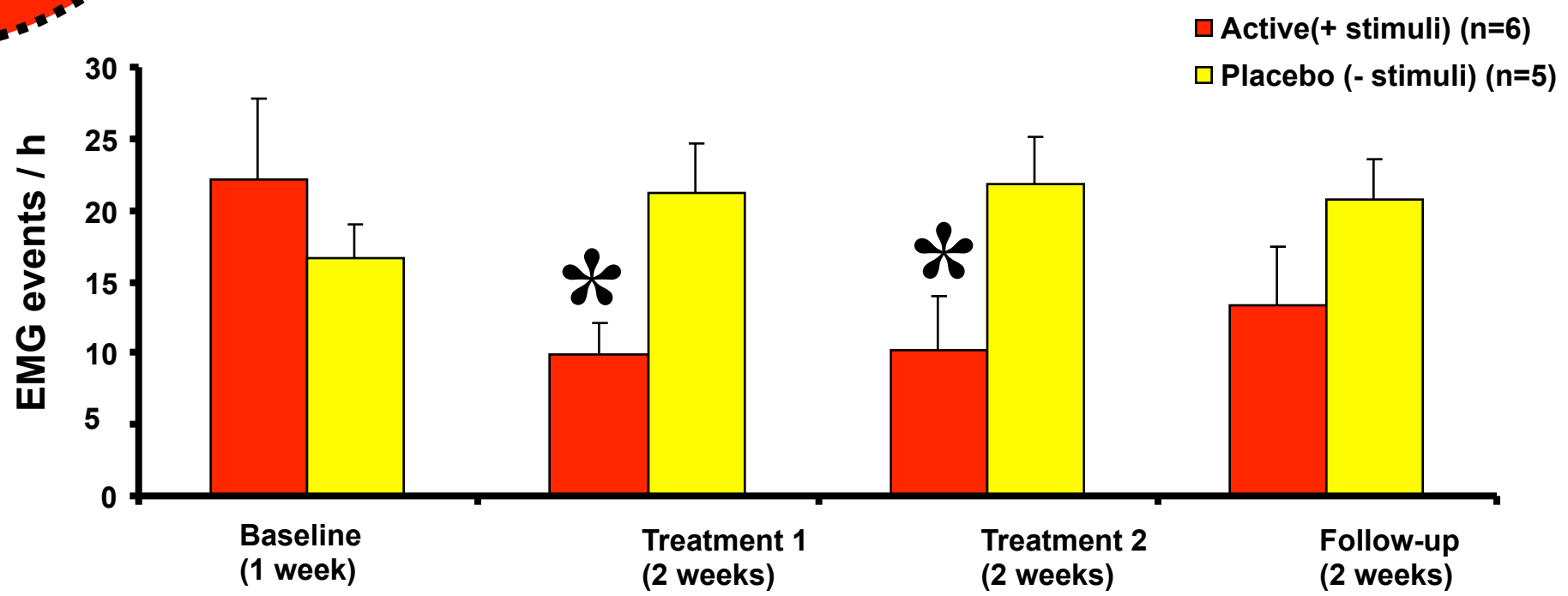


Svensson et al. 1998, 1999, 2000; Lund et al. 2008
Wang et al. 2001, 2002, 2005; Toriso et al. 2008

Use of EMG feedback

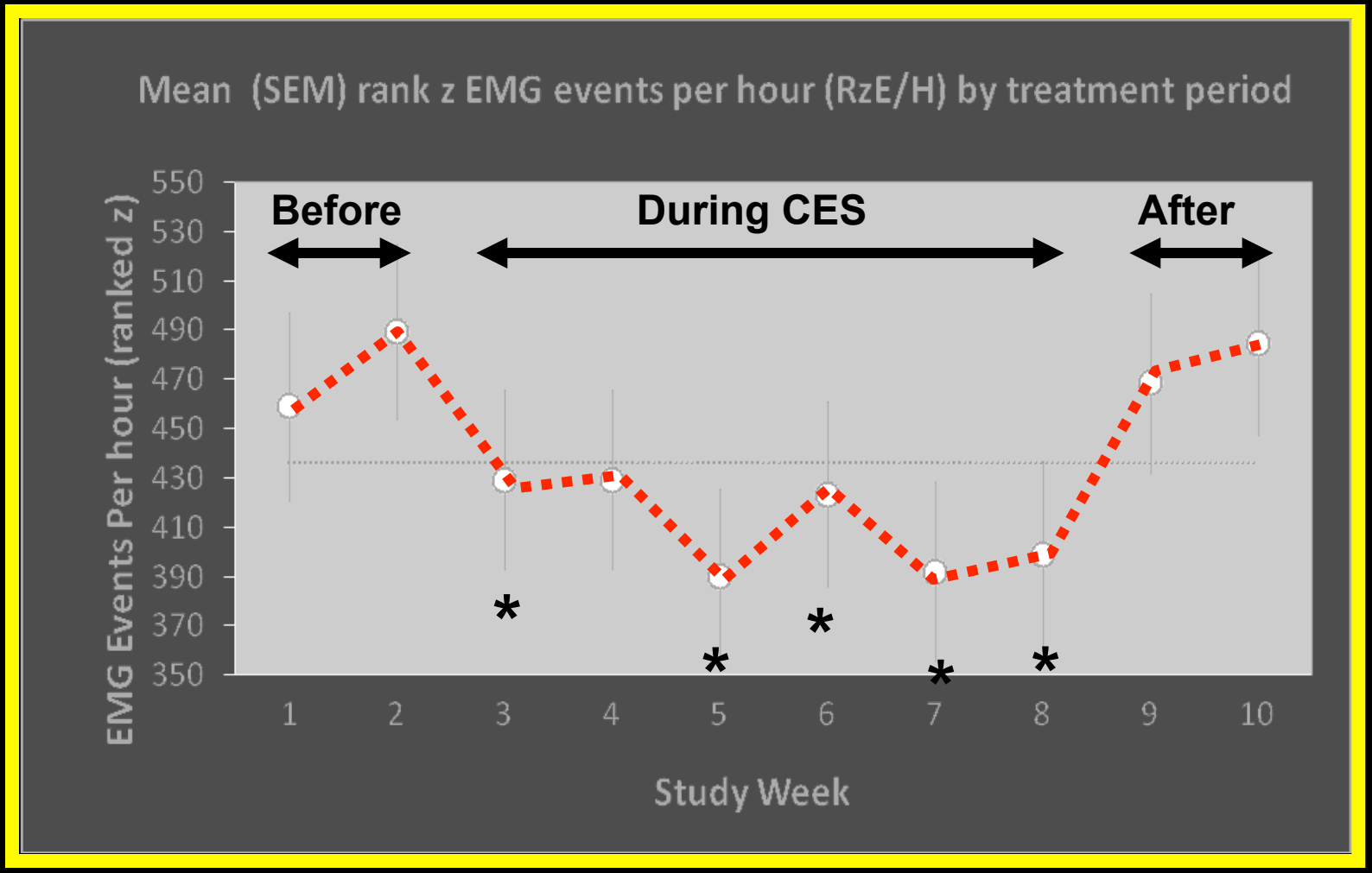
Randomized controlled trial

NEW !



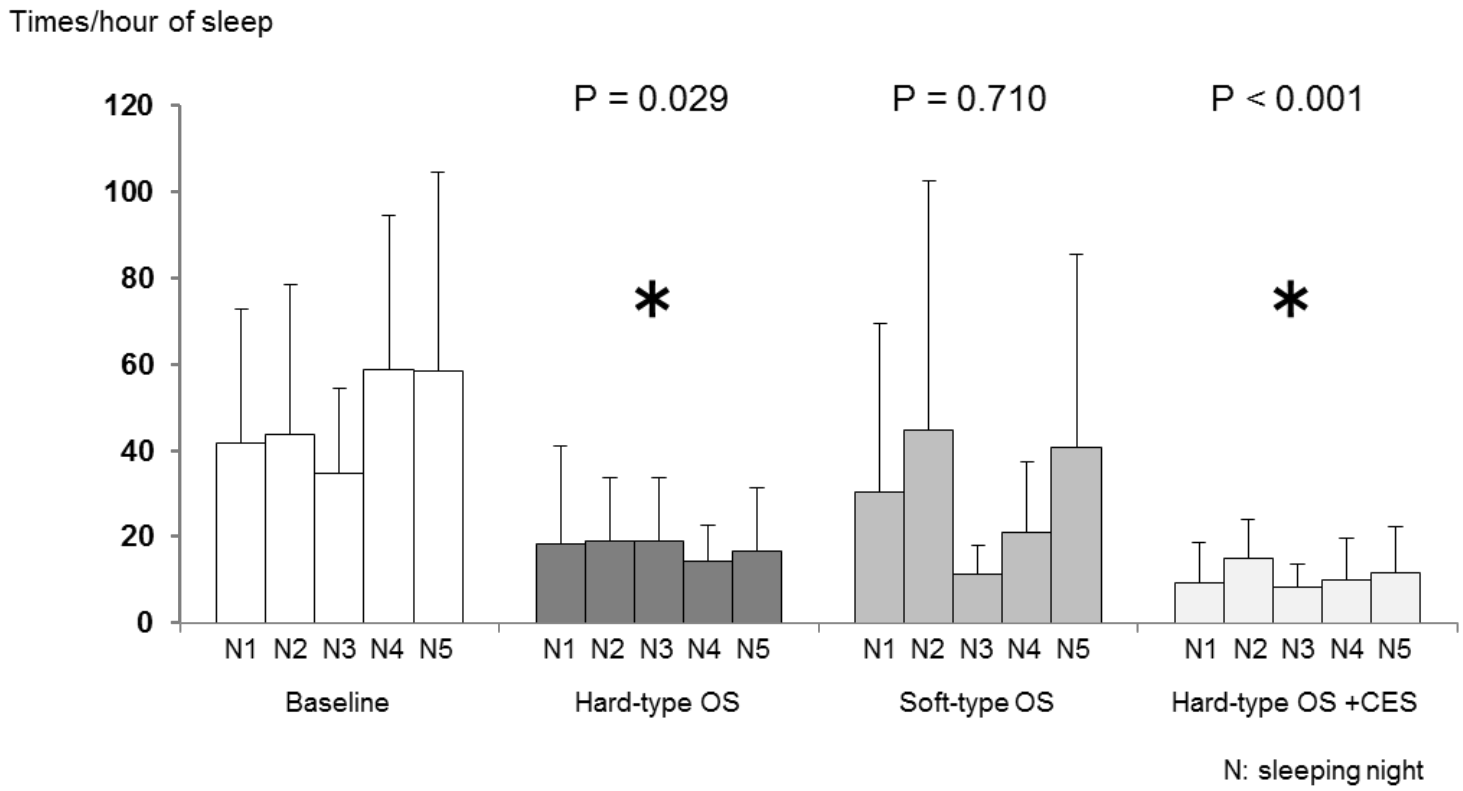
Jadidi et al. 2013

Case-series study



Raphael et al. J Orofac Pain 2012

Occlusal splints + CES



Arima et al. Appl Surface Sci 2012

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

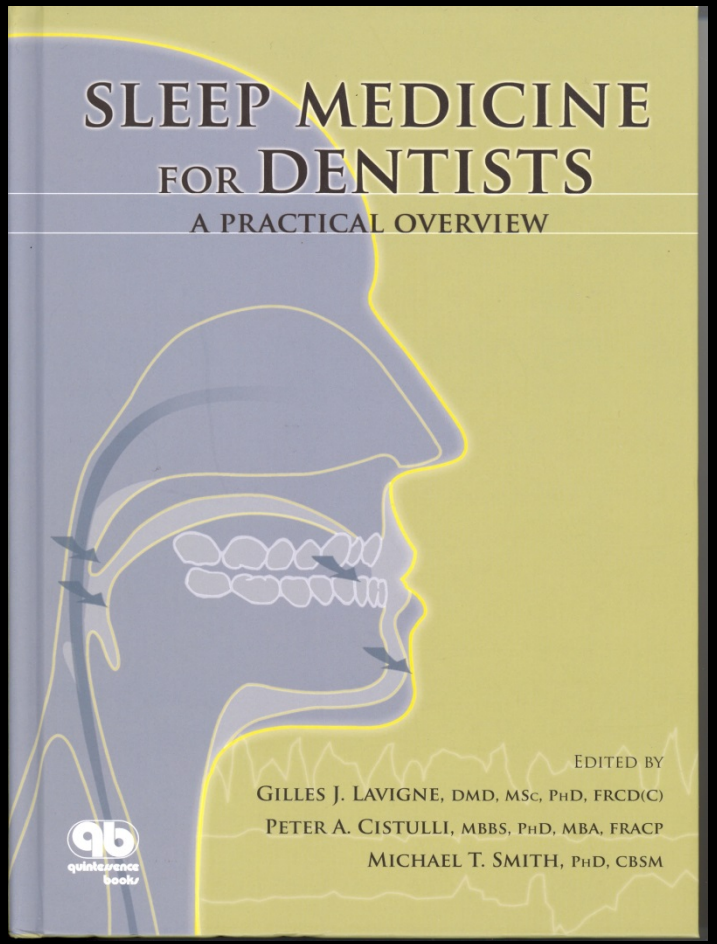
Take home message (1)

- 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 !
  - Councelling 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
EDITED BY
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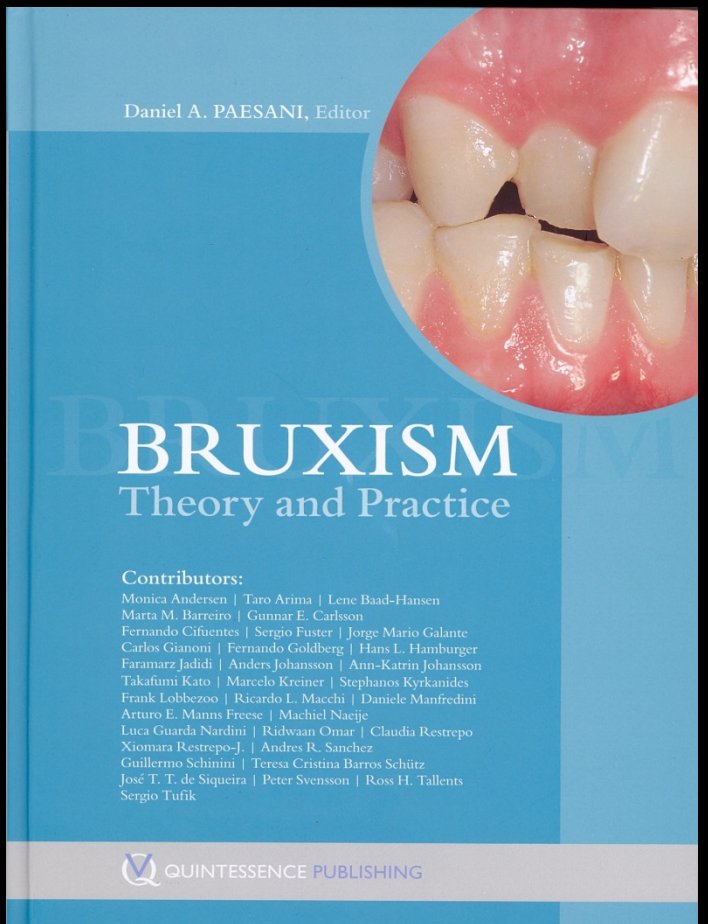
quintessence books


Daniel A. PAESANI, Editor
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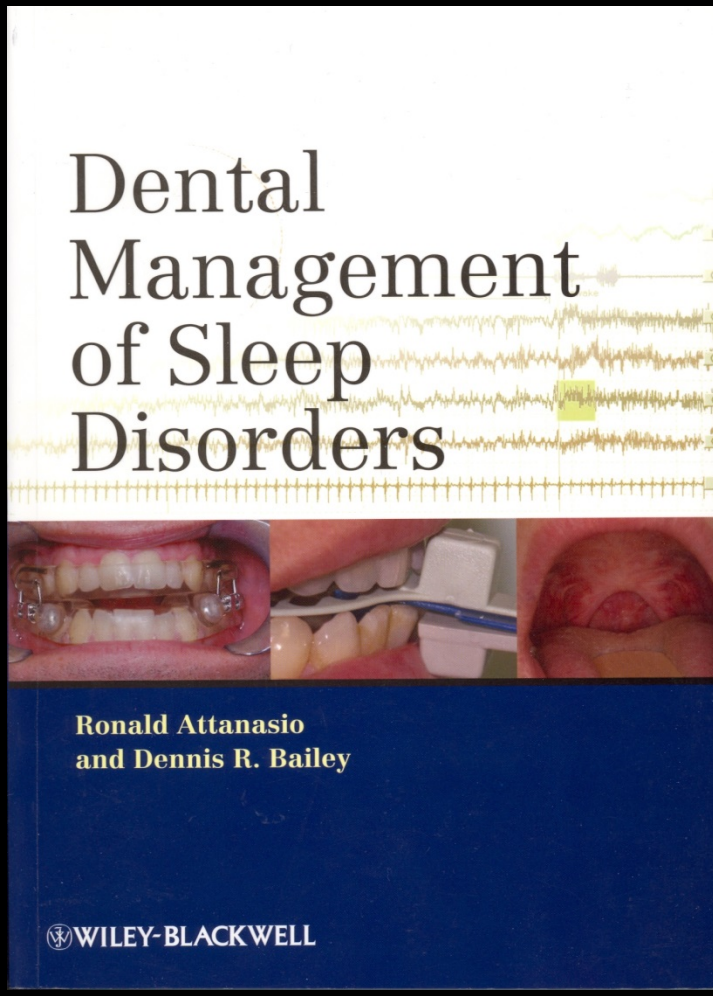
Dental
Management
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