

## Pain physiology and oro-facial pain evaluation

Sandbjerg August 28th 2015

Lene Baad-Hansen  
Dentist, Associate professor, PhD  
Section of Orofacial Pain and Jaw Function  
Department of Dentistry  
HEALTH  
Aarhus University

## Today's learning objectives

- Insight in trigeminal pain physiology
  - Important features of the nervous system
- Introduction to systematic evaluation of oro-facial pain mechanisms

## What is pain ?

## Definition of pain

“An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such”

IASP 1979


- Clinically, it seems important, **where** the pain is located
- Physiologically and with regard to management it is more important, which pathophysiological **mechanism** is responsible
- Psychological factors of great importance!!

## Pain


- Acute physiological pain
  - Warning about tissue damage
  - Direct activation of nerve fibers
- Chronic pain
  - Pain lasts beyond healing of damaged tissue

### Pain mechanisms


Nociceptive



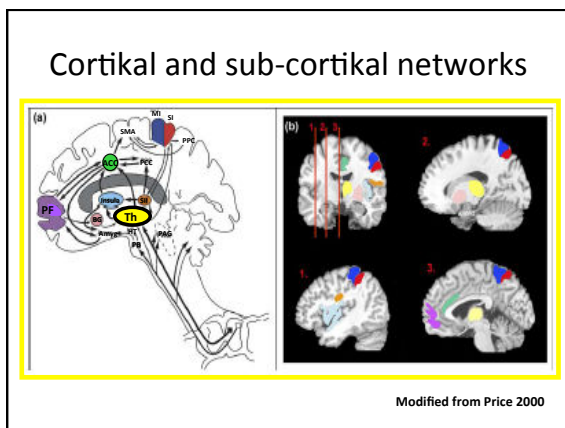
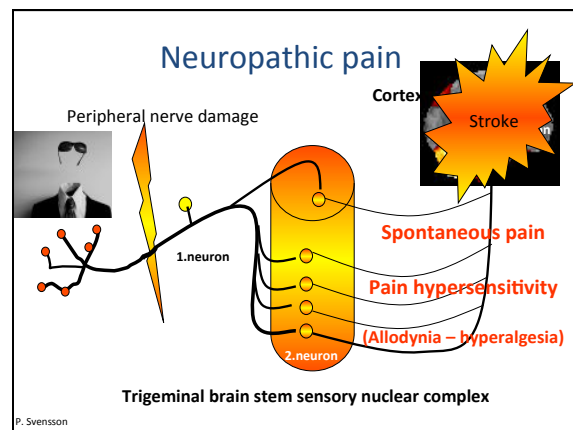
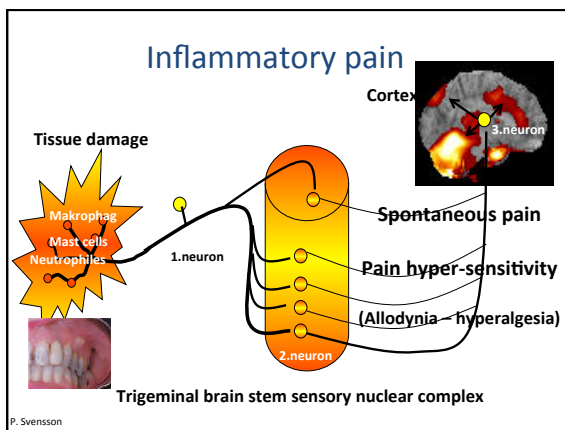
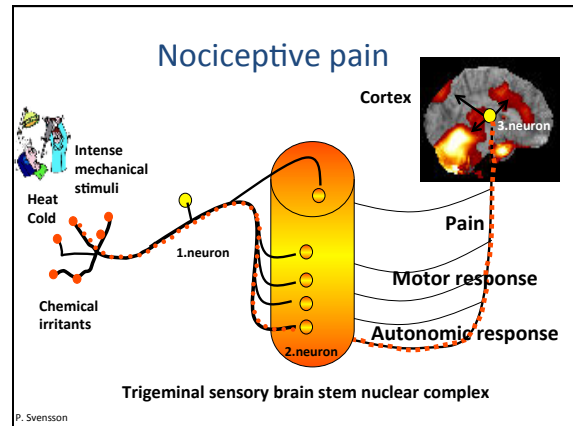
Neuropathic



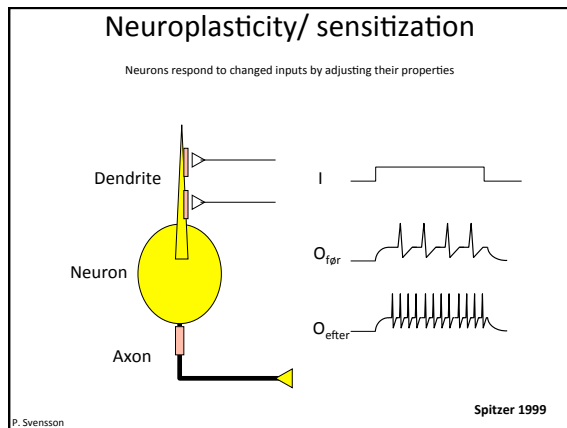
Inflammatory



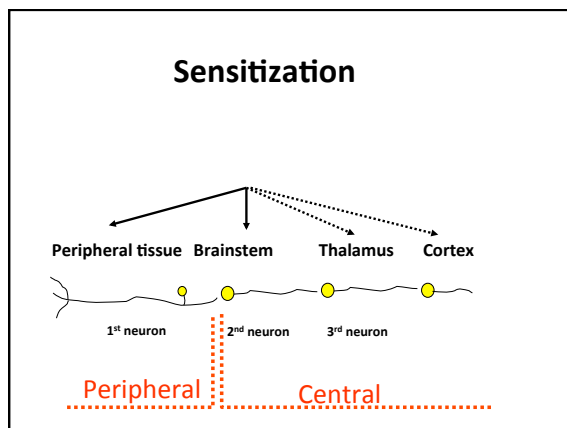
How do we tell them apart?



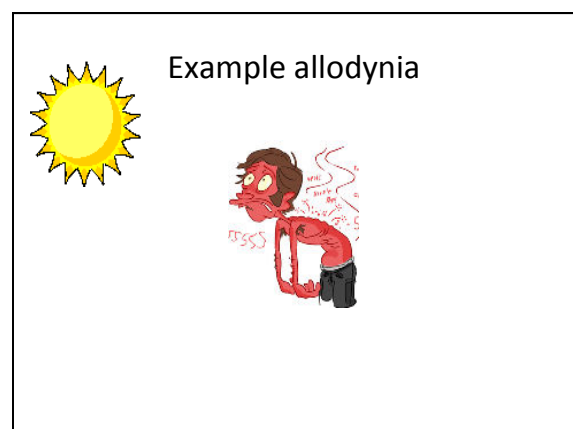
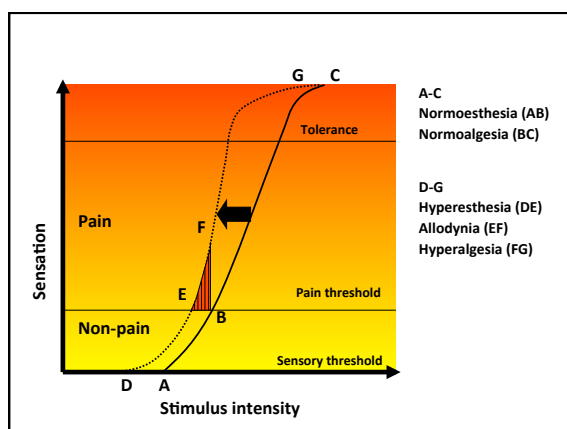
## Important properties of the pain system



- ### Neuroplasticity
- Changed response characteristics may be caused by
    - Up regulation of specific ion channels
    - Increased synaptic efficiency
    - Formation of new synapses/ opening of latent synapses
  - Function
    - Adaptive (learning, memory)
    - Maladaptive (persistent pain and sensitization)



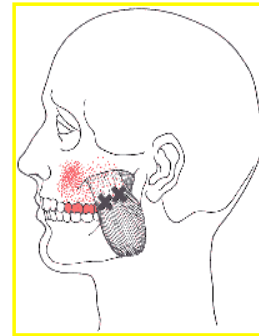
- ### Peripheral sensitization
- Spontaneous neuronal activity
  - Decreased thresholds for activation
  - Increased neuronal response
  - Involvement of adjacent nerve fibers



### Examples of sensitization in dentistry

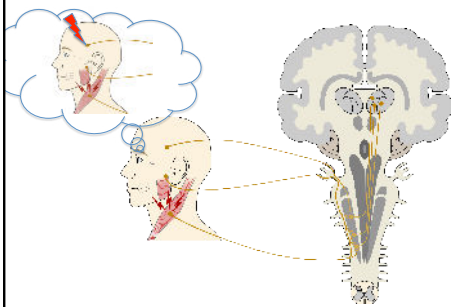
- Pain on muscle palpation = mechanical allodynia / hyperalgesia
- Tooth sensitive to hot and cold = thermal allodynia
- Pain on percussion = mechanical allodynia

### Spreading of pain



Travell & Simons 1983

### Referred pain



### Central sensitization

- Spontaneous neuronal activity
- Reduced activation thresholds
- Increased response
- Enlarged receptive fields
- Loss of pain inhibition

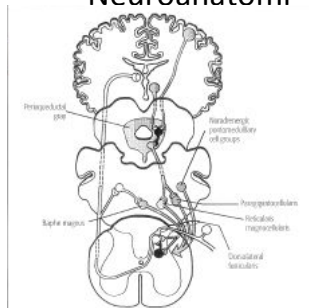
### Endogenous pain inhibition

### Endogenous pain inhibition

- Conditioned Pain Modulation (CPM)
- Pain at one body site can inhibit pain at another body site



## Neuroanatomy



## Activation of pain modulation

- Patients' expectations towards effect of pain killer
- Personality
- Psychological/ emotional factors
- (Bad) experience with fx dental treatment
- Hormonal levels
- Sleep
- Genetics
- Peripheral stimulation (fx TENS)
- Hypnosis

Svensson & Sessle 2003

## Summary

- Specialized nerve fibers transmit nociceptive information from orofacial tissues to the CNS, in which there is an ongoing integration and modulation of inputs

## Evaluation of orofacial pain?

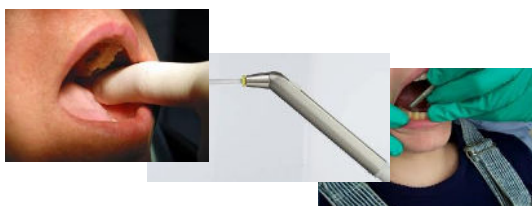
- Patient history
- Clinical examination
- Supplementary tests?



## How do we determine the origin of pain???

- 1. We ask the patient to point (spontaneous pain)
- 2. We do pain provocation tests (evoked pain)

- Important! Is the evoked pain familiar to the patient?



## Pain history

- Main complaint
- Description of pain: intensity, localisation, spreading, quality, duration, frequency, variation, provoking and relieving factors, accompanying symptoms
- Other pain conditions
- Diseases
- Former treatments
- Trauma
- Allergy
- Medicine
- Psychosocial conditions
- Dental history

## Pain intensity

### Visual analogue scale (VAS)



## Spontaneous pain

- Quality **Burning, pressing...**
  - McGill Pain Questionnaire
- Temporal characteristics
  - Debut, duration, frequency, persistence
- Spatial characteristics
  - Pain drawings



## Modifying factors

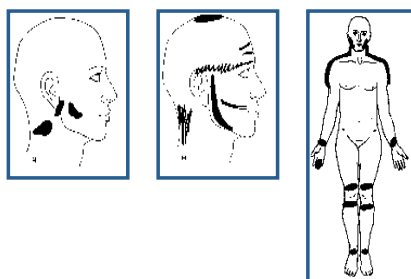
- Pain worsens
  - Chewing, jaw function
  - Cold / warmth
  - Stress
- Pain is relieved
  - Resting the jaw
  - Resting the body/ quiet
  - Activity / distraction
  - Medicine / treatment

## Pain history

- Relevant questionnaires
  - McGill Pain Questionnaire – pain quality and drawing
  - Diagnostic criteria for temporomandibular disorders (DC/TMD)
    - Pain intensity
    - Jaw function limitations
    - Disability (work and social life)
    - Psychological distress screening
- Pain diary (fx on smartphone app)



## Presentation of pain




McGill Pain Questionnaire pain drawings

## Clinical examination


- Intraoral examination
  - Teeth
  - Periodontium
  - Mucosa
  - Occlusion/articulation
- Extraoral examination
  - Swellings, asymmetry, skin
  - TMJ (screening – range of motion, noises, pain?)
  - Masticatory muscles (screening – palpation)
  - Sinus
  - Neck examination
  - Lymph nodes

### Supplementary examinations

- In dental chair
  - Diagnostic blocks
  - DC/TMD examination (TMJ, muscles)
  - Qualitative sensory tests
  - Articulator analysis etc.
- Imaging
  - Radiographs, CBCT
  - MRI
  - Ultrasound
  - Scintigraphy etc.
- › In the pain laboratory
  - › Quantitative sensory tests
  - › Electrophysiological tests of fx nerve function
  - › Experimental pain provocation
  - › EMG
  - › Sensory nerve action potentials (SNAP)
  - › Blood samples
  - › Synovial fluid
  - › Biopsy etc.




### Diagnostic blocks

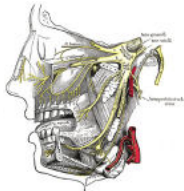


- Local anesthesia of suspected cause of pain
  - Teeth
  - Gingiva
  - Muscle
  - TMJ
  - Specific nerve branch
- If blocking tooth 16 relieves the pain, it is likely the cause...

### Diagnostic blocks




- Start as distally (on the nerve) and localized as possible
- 16 suspected cause: VAS before 7
  - Intraligamentary inj. 16: VAS after 2-4 min
  - Infiltration 16: VAS after 2-4 min
  - Infiltration 15: VAS
  - Infiltration 17: VAS
  - Tuber: VAS
  - Perhaps inj closer to midline




### TMD

- The most common cause of **chronic** facial pain
- Rare in children before puberty
- 9-15% of adult women
- 3-10% of adult men




LeResche et al. 2008

### TMD etiology




- Possible risk factors
  - Hormones
  - Hypermobility
  - Depression
  - Trauma
  - Anxiety
  - Malocclusion
  - Sexual abuse
  - Stress
  - Genetic factors
  - Somatization
  - Muscle hyperactivity...




### Diagnostic criteria

- Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)



Dworkin and LeResche 1992, Schiffmann et al. 2013

## DC/TMD



The most common TMD conditions

- Axis I Physical diagnosis
  - Muscle disorders
  - TMJ disorders
  - Headache (attributed to TMD)
- Akse II Psychological / psychosocial evaluation

Dworkin & LeResche 1992,  
Schiffman et al. 2013

## Diagnostic Criteria for the Most Common Temporomandibular Disorders

**GROUP I: MUSCLE DISORDERS**

- I.a. Myalgia (ICD-9 729.1).
- I.b. Myofascial Pain with Referral (ICD-9 729.1).

**GROUP II: JOINT DISORDERS**

- II.a. Arthralgia (ICD-9 524.62).
- II.b. Disc Displacement with Reduction (ICD-9 524.63).
- II.c. Disc Displacement with Reduction with Intermittent Locking. (ICD-9 524.63).
- II.d. Disc Displacement without Reduction with Limited Opening (ICD-9 524.63).
- II.e. Disc Displacement without Reduction without Limited Opening (ICD-9 524.63).
- II.f. Degenerative Joint Disease (ICD-9 715.18).
- II.g. Dislocation (ICD-9 830.0).

**GROUP III: HEADACHE**

- III.a. Headache attributed to TMD (ICHD 339.0).

Schiffman et al. JOP 2013

[www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org)

Home | RDC Assessment/Updates | Other Instruments | Research | Other Resources

Welcome!

The International RDC TMD Consortium Web site is back up, and new member logins have been distributed by e-mail.

**The Consortium is supported, as a Network, by the International Association for Dental Research.** Our goal is to advance the scientific knowledge of temporomandibular disorders (TMD) and related pain conditions, to establish evidence-based care for functional use, multi-site and cross-cultural research, research based on standardized assessment, annual meetings, and international consensus workshops. Our focus are intended to be applicable to both research and clinical settings.

**Announcements**

**RDC/TMD version 2 workshop (poster 4/19/11)**

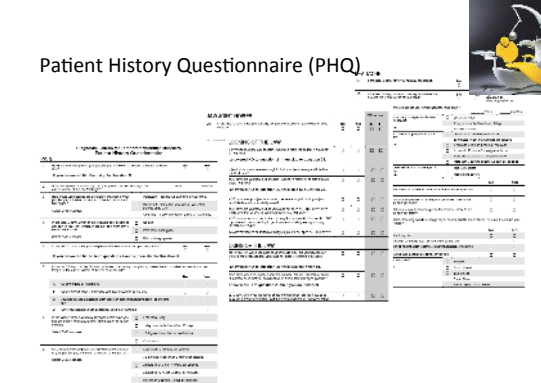
The Consortium and the Official TMD SAC of the IADR co-sponsored a second Invitational workshop. Held at Washington (Aug 2011) for the purpose of finishing content of the second revision of the RDC/TMD. Consortium members can review the meeting presentations and all the notes to make any comment on the next stage of developments. Stay tuned for more.

**This core set has established the Consortium, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), remains a model for pain research. This tool is being updated for clinical use (DC/TMD) and for the next wave of research regarding TMDs and how they are conceptualized (RDC/TMD 2.0). Our methods include population studies, clinical epidemiology and clinical trials, and expect the full human studies. Please contact us if you are interested in participating in our activities; our past meetings will give you a sense of what we do.**

**Website Updates**

(4/16/2011) The access to the website is being updated to improve functionality of the underlying software code. In the process, all links to internal pages and documents were lost, and the website has to be reconstructed. Pages are added in the process, and new content (see below) please send suggestions for further improvements and any cast lists to [rdc@rdc-tmd.org](mailto:rdc@rdc-tmd.org) (A new section, Research Protocols (under Other

## Patient History Questionnaire (PHQ)



## Operationalized examination

**III - Examiner Confirmation of Pain and Headache Location**

Examiner Instructions of Locations for Pain Reporting

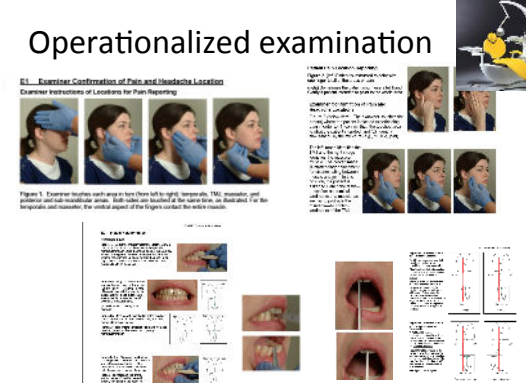
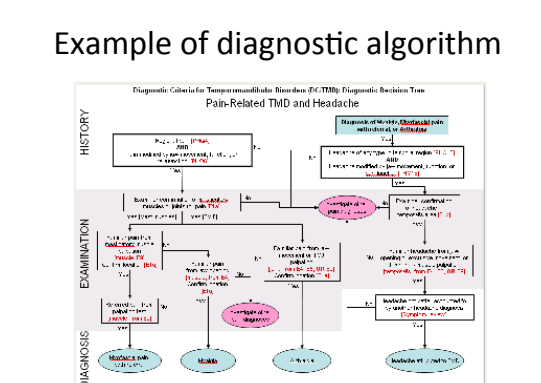


Figure 3. Examiner teaches each step in turn (from left to right). Temporally, TMD, musculoskeletal and non-musculoskeletal areas. Both sites are located at the same time, as described for the temporomandibular disorder. The vertical aspect of the fingers contact the entire mouth.

## Example of diagnostic algorithm

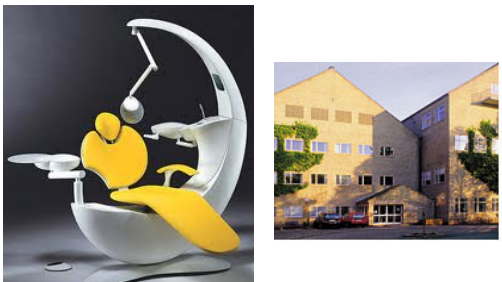
Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): Diagnostic Decision Tree

Pain-Related TMD and Headache



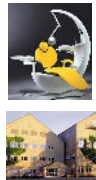


## Imaging




## Radiographs

- Teeth
- Panoramic
- Consider CBCT if persistent pain without radiographic findings on normal radiographs



## When to do imaging of TMJ

- Suspicion of trauma
- Suspicion of neoplasm
- Suspicion of or known generalized joint condition
- Lack of effect of conservative treatment
- Before invasive treatments
- Perhaps before large occlusal rehabilitations

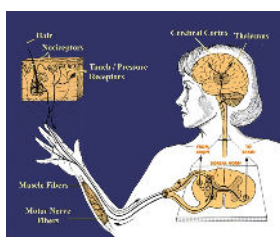


## MRI scan of TMJ

- To determine localisation of disc (if important for management strategy)
- Rule out tumours, growth disturbances
- Lack of effect of conservative management of disc displacement without reduction
- Soft tissue processes

## Neuropathic pain


- Pain due to lesion or disease affecting the somatosensory system



Treede et al. 2008

## Post-traumatic trigeminal neuropathic pain


- Can occur after trauma or dental treatment
  - Pulpectomy
  - Over-instrumentation endo
  - Extraction
  - Oral and orthognatic surgery
  - Injections



### Diagnosing neuropathic pain

Table	Grading system for neuropathic pain
Criteria to be evaluated for each patient	
1.	Pain with a distinct neuroanatomically plausible distribution <sup>a</sup>
2.	A history suggestive of a relevant lesion or disease affecting the peripheral or central somatosensory system <sup>a</sup>
3.	Demonstration of the distinct neuroanatomically plausible distribution by at least one confirmatory test <sup>b</sup>
4.	Demonstration of the relevant lesion or disease by at least one confirmatory test <sup>b</sup>

Grading of certainty for the presence of neuropathic pain:  
**definite** neuropathic pain: all (1 to 4); **probable** neuropathic pain: 1 and 2, plus either 3 or 4; **possible** neuropathic pain: 1 and 2, without confirmatory evidence from 3 or 4.



Treede et al. 2008

### Sensory testing on suspicion of neuropathic pain

Test systematically

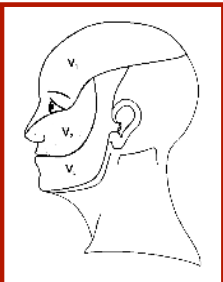
- V1
- V2
- V3

Compare sides

- Equal sens.
- Hypo-
- Hyper-


Different modalities

- Touch
- Thermal
- Pinprick




Baad-Hansen et al. 2013

### Qualitative sensory tests



Intra- or extra-orally

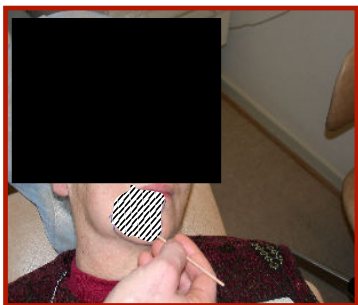
Baad-Hansen et al. 2013



Guidelines and recommendations for assessment of somatosensory function in orofacial pain conditions – a taskforce report – JOR 2011

Svensson P, Baad-Hansen L, Pigg M, List T, Eliav E, Ettlin D, Michelotti A, Tsukiyama Y, Matsuka, Jaaskelainen SK, Essick G, Greenspan JD, Drangsholt M

### Mapping of sensory disturbance



P. Svensson


### Confirmatory tests?

- Somatosensory
- Neurophysiological tests
- Imaging
- (Surgical inspection)

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### Case




- 59-year old woman
- Endo 46 with excess sealer
  - “My chin feels numb on the right side”
- 13 months: “the numb area is getting bigger and it “tickles”
- 18 months: “the numb area is still getting bigger and deeper and I have pain in the area”
- 2 ½ years: Apicectomy gives immediate but shortlasting relief of the pain
- 2 ¾ years: Pain is back – referred to Dept. of Dentistry, Aarhus

### Case

- Tentative diagnosis:
  - Damage to inferior alveolaris nerve with neuropathic pain
- Confirmatory tests?
  - Quantitative sensory tests
  - Neurophysiological test

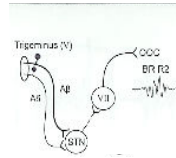

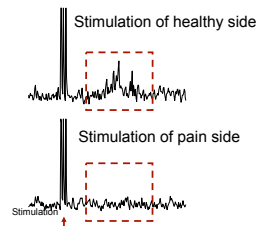
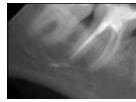
### Case



	Pain side (mental region)	Healthy side
Cold detection threshold	29,5 °C ↓	31,1 °C
Warmth detection threshold	32,9 °C ↓	32,6 °C
Cold pain threshold	30,6 °C ↓	31,5 °C
Heat pain threshold	35,3 °C ↓	33,8 °C
Mechanical detection threshold	64 mN ↓	0,18 mN
Mechanical pain threshold	158 mN ↓	0,71 mN
Mechanical pain sensitivity	1 ↓	21
Pressure pain threshold	160 kPa ↓	95 kPa

↓ Sensory loss

### Blink reflex Case

### Case

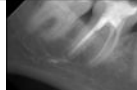


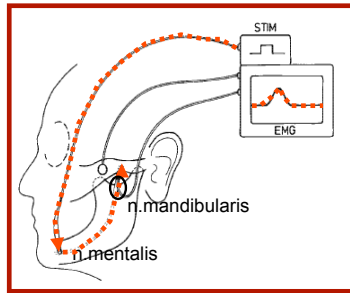
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### Case

- Definite neuropathic pain diagnosis
- Legal issues

### Neurophysiology Sensory Nerve Action Potentials (SNAP)



Jaaskelainen et al. 2005