2017 Oregon Dental Conference®
Course Handout

Ken Hargreaves, DDS, PhD
Course 8139: “Diagnosing the Non-odontogenic Toothache”
Friday, April 7
2 pm - 5 pm
Prevalence of Dental Pain

- 12-14% of pop’n reports dental pain
  - Lipton et al. *JADA* 124:115, 1993
  - Riley & Gilbert *Pain* 90:245, 2001
- The symptom of dental pain could be due to:
  - Odontogenic mechanisms
  - Non-odontogenic mechanisms
- Clinicians must be diligent in establishing a differential Dx in all cases

Odontogenic vs Non-Odontogenic Pain

- Odontogenic Pain
  - Reversible pulpitis
  - Irreversible pulpitis
  - Acute apical periodontitis
  - Acute apical abscess

- Non-Odontogenic Pain
  - Musculoskeletal
  - Neuropathic
  - Neurovascular
  - Inflammatory Conditions
  - Systemic Disorders
  - Psychogenic (Somatoform Pain Disorder)

Goal:

To provide practical review of most Common types of Non-Odontogenic Pain (not encyclopedic review)

Common Features of Odontogenic Pain

- Etiologic factors are present
  - eg, Caries, leaky restorations, trauma, fx, etc
- Chief complaint can be reproduced
- Pain reduced by LA
- Unilateral pain
- Pain qualities: dull, aching, throbbing
- Dx Specific: Localized pain
- Dx Specific: Thermal alldynia
- Dx Specific: Mechanical alldynia

“Common” ≠ “Ubiquitous”

- Discriminant analysis of N = 74 orofacial pain patients
- Thermal Alldynia:
  - Odds ratio of 9.0 for Pulpitis vs AAP (p<0.001)
- Mechanical Alldynia:
  - Odds ratio of 6.9 for AAP vs pulpitis (p<0.01)
- THL: Common findings can still be Diagnosis-Specific
Common Features of Non-Odontogenic Pain

- No apparent odontogenic etiologic factors
  - No caries, leaky restorations, trauma, fx, etc
- Pain not consistently reduced by LA
- Bilateral pain or multiple teeth or changing location
- Pain can be chronic and non-responsive to Tx
- Dx Specific: Pain qualities
  - burning, electrical shooting, stabbing, dull ache
- Dx Specific: Pain occurs along with a headache
- Dx Specific: Palpation trigger points/muscle incr pain
- Dx Specific: Exercise, stress, head position incr pain

Seltzer & Hargreaves, in: Seltzer & Bender’s Dental Pulp, 2002

Mechanisms of Non-Odontogenic Pain

- Referred pain
  - Convergence
  - Receptive field expansion due to central sensitization
- Systemic disorder that interacts with pulpal or periradicular tissue
  - Pain not derived from common dental pathosis
  - Herpes zoster, neoplasia, sickle cell, etc
- Psychosocial – Psychogenic
  - Mandarin-speaking Chinese refer to tooth drilling as “sourish”
  - Women have lower EPT thresholds in Dental Op vs Research Lab
  - Dworkin J Cranio 6:301, 1992
  - Psychogenic – somatoform pain disorder
  - Manchusenn’s syndrome

Seltzer & Hargreaves, in: Seltzer & Bender’s Dental Pulp, 2002

Convergence

The “Site” of pain perception is different from the “Origin” of nociceptor activation

Local Anesthetic Blocks and Local Stimulation (eg, palpation) can distinguish “site” from “origin”

Seltzer & Hargreaves, in: Seltzer & Bender’s Dental Pulp, 2002

Pain Referred from Nociceptors in Muscle

Travel & Simons in: Myofascial Pain & Dysfunction 1983

Pain Referred from Nociceptors in Pulp or Periradicular Tissue

Falace, Reid & Ravens J Orofacial Pain 10:232, 1996

Convergence

The “Site” of pain perception is different from the “Origin” of nociceptor activation

Seltzer & Hargreaves, in: Seltzer & Bender’s Dental Pulp, 2002
Experimental Support for Convergence

Central Sensitization and Referred Pain

Central Sensitization and Referred Pain

Pulpal Nociceptors Evoke Central Sensitization

Pulpal Pain Intensity Increases Referred Pain

Pain Intensity and Referred Pain
Ischemic Pain Reduces Pain Referred from Pulpitis

Non-Odontogenic Pain

- Musculoskeletal
- Neuropathic
- Neurovascular
- Inflammatory Conditions
- Systemic Disorders
- Psychogenic (Somatoform Pain Disorder)

Differential Dx Features of Musculoskeletal vs Odontogenic Pain

- Pain often not restricted to single tooth
  - Pain often diffuse & extraoral
- Pain increased by muscle palpation
- Pain not reduced with intraoral LA
- Pain can be reduced by LA in trigger point
- Pulpal thermal allodynia not usually observed

Common Referral Patterns Musculoskeletal Pain

- Superior Belly of Masseter
  - Maxillary posterior teeth
- Inferior Belly of Masseter
  - Mandibular posterior teeth
- Anterior Digastric
  - Mandibular anterior teeth
- Temporalis
  - Maxillary teeth (anterior or posterior)

Pain Referred from Nociceptors in Muscle

Non-Odontogenic Pain

- Musculoskeletal
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Musculoskeletal Pain

- N = 230 TMD patients
  - 85% report referred pain after 5 sec firm palpation of muscle or trigger point
  - Cheek: 21% of all referred pain
  - Ear: 14.6%
  - Forehead: 14.5%
  - Teeth: 11.6%

Conclusions from the Wright Study

- Molars are the most frequent teeth to receive pain referred from muscles
- The masseter is the most common muscle referring pain to teeth
  - Sampling bias?
- Frequency of Maxillary = Mandibular teeth
- Four sites produced 94% non-odontogenic pain
  - Masseter, Lateral Pterygoid, Temporalis, TMJ
- Seven other sites relatively infrequently refer pain to teeth
  - Medial pterygoid, coronoid process, trapezius, splenius capitus sternocleidomastoid, anterior & posterior digastric

Treatment for Musculoskeletal Pain

- Identification & elimination of contributory factors (e.g., habits, grinding teeth)
- Spray and stretch
- Mild analgesics
- Massage
- Splints
- Biofeedback
- Deep heat

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Non-Odontogenic Pain

- Musculoskeletal
- Neuropathic
  - Trigeminal neuralgia (tic doloureux)
  - Atypical odontalgia (phantom tooth pain)
- Neurovascular
- Inflammatory Conditions
- Systemic Disorders
- Psychogenic (Somatoform Pain Disorder)

Trigeminal Neuralgia

- Unknown etiology
  - Vascular compression hypothesis (CCI model)
  - Mandibular > Maxillary >> Ophthalmic
- Differential Dx features vs Odontalgia
  - Severe, paroxysmal (10-30 sec) episodes of shooting, electrical pain
    - Pain often runs along nerve’s distribution
  - Trigger points (may only need gentle stimulation)
  - Pain unrelieved by intraoral LA (unless trigger point)
  - No thermal allodynia
  - If in young adults, consider multiple sclerosis

Seltzer & Hargreaves, *in: Seltzer & Bender’s Dental Pulp*, 2002

Trigeminal Neuralgia

- N = 41 pts with T.N. or pre-trigeminal neuralgia
  - 61% report Hx of initial dental pain
  - Merrill & Graff-Radford *JADA* 123:63, 1992
- Pts with T.N. may receive RCT
  - Law & Lilly *OOOE* 80:96, 1985
  - Francica et al., *JOE* 14:360, 1988
  - Goddard *J Cranio* 10:25, 1992
- Pts with odontalgia may be treated for T.N.
  - Donlon *Anesth Prog* 36:98, 1989
- In both cases, lack of response to tx was key factor

Case Report Trigeminal Neuralgia

- 47 yo female. cc: Pain LLQ started few months ago
  - Dec: Examined #18: no caries, pocket (5mm), Fx? + sweets
  - Feb: Still pain. Replace Class I amalgam #18
  - June: Tingling L face remove D caries #23
  - June: Severe pain. Appears localized to #23, RCT #23
  - July: Pain #20-21 while eating
  - Aug: #21 + hot/cold; completed RCT #20 & 21
  - Sept: Burning, searing pain; + eating sweets, RCT #18
  - Nov: Pain duration 1 min LLQ, RCT #22
  - Nov: Refer to neurologist. Rx Tegretol 200 mg

Seltzer & Hargreaves, *in: Seltzer & Bender’s Dental Pulp*, 2002

Treatment for Trigeminal Neuralgia

- Gabapentin
- Baclofen
- Phenatoin
- Valproic acid
- Carbamazepine
- Intraoral capsaicin
- Surgical decompression

Seltzer & Hargreaves, *in: Seltzer & Bender’s Dental Pulp*, 2002
Atypical Odontalgia

- Unknown etiology
  - Often associated with Hx trauma or inflammation
  - Marbach 1978, 1996
  - May be 10X more prevalent than trigeminal neuralgia

- Hypotheses:
  - Deafferentation
    - Marbach 1993; Solberg 1988
  - Vascular
    - Marbach 1993; Solberg 1988
  - Sympathetic
    - Vickers 1998
  - Psychosocial
    - Yes: Marbach 1993

Differential Dx Features of Atypical Odontalgia

- Pain often not restricted to a tooth
  - Pain can be diffuse
  - Pain can occur in edentulous area
  - Pain can change in location over time
- Constant dull, aching, throbbing, burning
- Pain may or may not be reduced by intraoral LA
- Pain often lasts > 4 months
- Pain not altered by intraoral thermal stimuli
- Often report Hx ineffective dental tx

Atypical Odontalgia

- N = 42 patients with Atypical Odontalgia
  - 86% female
  - 78% cases involve maxillary pain
    - Molars 59%
    - Premolars 27%
    - Canines 7%
- Up to 87% pts report pain shifting in location over time. Often crosses midline
  - Kreisberg JADA 104:852, 1982
  - Lilly & Law JOE 23:337, 1997
  - Vickers OOOOE 85:24, 1998

Atypical Odontalgia

- Pts with A.O. may receive many RCT or extractions
  - Kreisberg 1982; Reik 1984;
  - Solberg 1988; Lilly 1997;
  - Battrum 1996
- Lack of response to dental Tx was key factor
- In one case, lack of pain reduction after LA injection prompted expansion of Diff Dx
  - Kreisberg JADA 104:82, 1982

Case Report: Atypical Odontalgia

- 39 yo female: cc: Severe dull pain R zygomatic-facial
  - Recent full mouth prosth for TMD
  - Pain localized URQ
  - RCT several Max R teeth (#4-7) with no change pain
  - ENT referral excluded sinus
  - Neurological referral excluded neuropathic pain
  - Referred to endodontist for AE/RF #8:
    - But: LA injection had no effect on pain.
  - Myofascial exam (with LA in trigger points) no effect on pain
  - Dx A.O. Rx amitryptaline 25-75 mg reduced pain by 70%
  - Kreisberg JADA 104:852, 1982
Treatment of Atypical Odontalgia

- Tx often problematic
  - Dental tx generally ineffective
- TCA
- Capsaicin
- Sympathetic block
- Systemic lidocaine
- EMLA cream (Vickers 1988)

NICO
( Neuralgia Inducing Cavitation Osteonecrosis)

- NICO “cavitational defects”
  - Ratner 1979; 1986; Roberts 1984
- Dx test = rapid pain reduction with LA injection
- Arguments in support of NICO
  - Bone cavities due to bacterial osteomyelitis or vascular pathosis after extraction
  - Bouquot & McMahon JOMS 58:1003, 2000
- Arguments against NICO
  - Bone cavities are found in normal subjects and are not found in all pain patients
  - Zuniga JOMS 58:1021, 2000

Non-Odontogenic Pain

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Migraine

- Common form of neurovascular pain in trigeminal system
- Neurovascular hypothesis: vasodilation of cephalic and cerebral arteries with activation of sensitized nociceptors
- Genetic risk factors (5HT\textsubscript{2A} receptor)
- Classic migraine (has aura) is a risk factor for stroke
- Common migraine – no aura
Differential Diagnosis of Migraine

- Pain not restricted to a tooth (diffuse)
- Dental pain temporally correlated with headache
- Unilateral dull, throbbing pain
- Intraoral LA block is ineffective
- Pain not altered by thermal stimuli
- Physical activity (stairs) increases pain
- Nausea, emesis, sensitivity to light & sound, Δ mood
- Often female patients < 50 years

Migraine

- Case report: 35 yo female
  - Pain localized in mandibular canine
  - Pain presented with nausea & sensitivity to sounds
  - Pain persisted after extraction
  - Pain treated with sumatriptan & cessation of BCPs
  - Namazi *Headache* 41:420, 2001

Migraine Treatment

- Triptans (eg., sumatriptan)
- 5HT₁ or 5HT₃ antagonists
- Gabapentin

Cluster Headache

- Unknown etiology
  - Hypothesis: episodic vasodilation activates sensitized nociceptors
- “Cluster” implies that pain episodes generally last 6-8 weeks with long pain-free periods
- Cluster headaches are less prevalent than migraines

Differential Dx of Cluster Headaches

- Pain not restricted to a tooth
  - Often includes max post teeth with retroorbital or sinus
  - May coincide with rhinorrhea, nasal congestion, or lacrimation of the involved eye
- Pain can be increased by drugs, sleep onset
  - Alcohol, cocaine
- Pain unrelieved by LA block
- Pain not altered by thermal stimuli
- Pain Quality: Hot, stabbing, paroxysmal
- Pain attacks often occur at same time of day and last 30-60 min
- Occurs most often in males (6:1 M:F) 30-50 years

Cluster Headaches

- In one study, 43% pts with cluster headache were initially treated by a Dentist
  - Bittar 1992
- Cocaine can evoke CH with 1-2h delay
  - Penarrocha 2000
- Treatment of Cluster Headache
  - Oxygen therapy
  - Sumatriptan
  - Prednisone
  - Gabapentin
  - Calcium channel blockers

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Sinusitis

- Two major types of sinusitis
  - Bacterial infection
  - Allergies (more common form)
- Etiology of non-odontogenic pain
  - Referred pain mechanisms
  - Acute neuritis of dental nerves

Differential Dx of Sinusitis

- Pain often multiple max posterior teeth
  - May include malar and maxillary alveolus regions
- Pain may/may not be partially relieved by LA
- Pain increased by percussion (Mech. Allodynia)
- Pt may report sense of fullness or pressure
  - Usually infraorbital region over involved sinus
- Positive “Head Dip” test
- Diagnostic LA tests:
  - Intranasal 4% lidocaine spray
  - 5% lidocaine in middle meatus for 30 sec

Sinusitis

- Bacterial sinusitis
  - Severe, throbbing, stabbing pain with pressure
  - Often purulent nasal discharge
  - 70% caused by Strept pneumoniae, H. influenza
  - Tx: Augmentin, Bactrim DC
- Allergic sinusitis
  - Tends to be seasonal in colder climates
  - Chronic dull ache in max posterior teeth
  - Pts may report “itching” sensation in teeth
  - Tx: antihistamines or decongestants

Case Report: Sinusitis

- Waters view
- L mucosal thickening
- R superior position of the air-fluid level

Okeson & Falace  DCNA 41-367. 1997
Non-Odontogenic Pain

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What’s New in Diagnosis?
Bisphosphonates

-流行 class of drugs used to retain bone
  - Non-neoplastic diseases
    - osteoporosis, ankylosing spondylitis, corticosteroid-induced bone loss and Paget’s disease
  - Cancers
    - neoplastic hypercalcemia, multiple myeloma and bone metastases secondary to breast and prostate cancer
- Rx of Alendronate (Fosamax™)
  - 21 million Rx in 2004

What’s New in Diagnosis?
Bisphosphonates-Associated Osteonecrosis

- An irregular mucosal ulceration with exposed bone in the mandible or maxilla
- Pain or swelling in the affected jaw
- Infection, possibly with purulence
- Altered sensation (eg., numbness or heavy sensation).
What’s New in Diagnosis?
Bisphosphonate-Associated Osteonecrosis

63 Cases:

- 57% Pamidronate (Aredia™)
- 31% Zolendronate (Zometa™)
- 10% Alendronate (Fosamax™)


Case Report

- 72 yo white male
- Cc: ulcers lingual Lower Left 1st & 2nd Molars
  Persisted for 10 months
  - Tingling and burning sensation
  - Med Hx: prostate cancer, diabetes
  - Meds: iv Zolendronate 1/month X 15 months.
    - Others: omeprazole, dutasteride, celecoxib, glimepiride, aspirin, lycopene, sildnitral, co-enzyme Q-10 and melatonin
  - NSRCT on Lower Left 1st & 2nd Molars
  (7 after zolendronate started)
  - 1month Pen VK and metronidazole helped to reduce pain, but did not resolve area on bone exposure

Sarathy, Bourgeois & Goodell JOE 31: Oct 2005

Bisphosphonates

<table>
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<tr>
<th>Subclass of Bisphosphonate</th>
<th>Generic Name</th>
<th>Trade Name</th>
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<tbody>
<tr>
<td>Aminobisphosphonate</td>
<td>Zolendronate (Zoledronic acid)</td>
<td>Zometa™</td>
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<tr>
<td>Aminobisphosphonate</td>
<td>Pamidronate</td>
<td>Aredia™</td>
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<td>Alendronate</td>
<td>Fosamax™</td>
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<td>Actonel™</td>
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<td>Non-aminobisphosphonate</td>
<td>Tilmudronate</td>
<td>Skelid™</td>
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<td>Bonefox™, Ostac™</td>
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<tr>
<td>Non-aminobisphosphonate</td>
<td>Endrotrate</td>
<td>Didronel™</td>
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Aminobisphosphonates aka “nitrogen-containing” bisphosphonates

Endodontic Recommendations

- Recognize the risk factors of bisphosphonate associated ONJ.
- Patients at HIGHER risk for bisphosphonate associated ONJ include those patients taking i.v. bisphosphonates.
  - Preventive procedures are very important to reduce the risk of developing ONJ because treatment of ONJ is not predictable at this time.
  - Preventive care
    - Caries control, conservative periodontal and restorative treatments, and, if necessary, appropriate endodontic treatment.
    - Analogy to osteoradionecrosis: Consider NSRCT of teeth that otherwise would be extracted.
  - Teeth with extensive carious lesions
    - Consider NSRCT, crown resection and restoration similar to preparing an overdenture abutment.
  - Avoid surgical procedures
    - Tooth extractions, endodontic surgical procedures or placement of dental implants.

What’s New in Diagnosis?
Bisphosphonate-Associated Osteonecrosis

- Often associated with prior dental tx
  - Extractions, perio surgery
- Diagnostic challenge:
  - Pt often presents to dentist with cc of pain
  - Sarathy et al., JOE Oct 2005
  - Katz JOE Nov 2005
Endodontic Recommendations

- Patients at LOWER risk for bisphosphonate associated ONJ include those patients taking oral bisphosphonates.
  - Appropriate clinical procedures: intraoral examination and indicated dental tx, and patient education about the symptoms of bisphosphonate osteonecrosis of the jaws and their low risk
- Consider bisphosphonate associated ONJ when developing a differential diagnosis of non-odontogenic pain.

Endodontic Recommendations

- Utilize the entire health care team, including the patient’s general dentist, oncologist and oral surgeon, when developing treatment plans for these patients.
- Cases of bisphosphonate associated osteonecrosis of the jaws should be reported to the U.S. FDA MedWatch Online at: https://www.accessdata.fda.gov/scripts/medwatch/. Additional background information on how to report adverse effects of drugs can be found at: http://www.fda.gov/opacom/backgrounders/problem.htm
- Be aware that the knowledge base for bisphosphonate associated ONJ is rapidly increasing and it is likely that these recommendations may change over time. Thus, the prudent practitioner is encouraged to continue to review new publications in this area.

Bisphosphonates Additional Information

- Bisphosphonates
- FDA Report on Bisphosphonates
- Novartis PC. Recommendations for prevention, Dx and Tx of ONJ

Cardiac Pain

- 10% of cases may have pain referred to left posterior or inferior border of mandible
- May or may not occur with substernal pain
- Intraoral LA injection has no effect
- Nitroglycerin may reduce pain
- Drinnan 1987; Batchelder 1987
- Sandler 1995

Herpesvirus Infections

- Can produce dental pain prior to forming vesicles
- Case reports of pulpitis-like symptoms
  - Sigurdsson & Jacoway 1995
  - Lopes et al., 1998
- Case reports of necrosis with PARLs
  - Gregory et al., 1975
  - Goon & Jacobsen 1988
  - Rauckhorst & Baumgartner 2000
- Common feature: life-stressor triggering an outbreak in older pt

Case Report: Herpes Zoster

- 72 yo female reports dull pain LRQ last 3 days
  - Localized to LR premolar & radiated to R eye/ear
  - Hx squamous cell carcinoma on arm 3 yr ago
  - Pain kept awake last 2 nights.
  - OTC analgesics did not help
  - All + cold no lingering Neg perc/palp. No PARL.
  - #28 vital/ Removed leaky crown & placed IRM
  - Returned 3d later with swelling and blisters. Intense pain radiated to R ear
  - Rx acyclovir 800 mg q6h & ibuprofen 600 mg q4-6h
Case Report: Herpes Zoster

Sickle Cell Anemia

- 68% of N = 51 pts reported dental pain with or without evident dental pathosis
  - 1 year period
  - O’Rourke 1990; 1998
- Most common facial site is mandible
- Mechanisms
  - Asymptomatic pulpal necrosis
  - Generalized vascular pathosis

Neoplasia Associated with Non-Odontogenic Dental Pain

- Metastases from breast, lung, prostate
- Glioblastoma multiforme
- Osteoblastoma
- Carcinoma
- Sarcoma
- Non-Hodgkins lymphoma
- Burkitt’s lymphoma

Case Report: Non-Hodgkin’s Lymphoma

- Metastasis from breast, lung, prostate
- Glioblastoma multiforme
- Osteoblastoma
- Carcinoma
- Sarcoma
- Non-Hodgkins lymphoma
- Burkitt’s lymphoma

Case Report: Non-Hodgkin’s Lymphoma

- Metastases from breast, lung, prostate
- Glioblastoma multiforme
- Osteoblastoma
- Carcinoma
- Sarcoma
- Non-Hodgkins lymphoma
- Burkitt’s lymphoma

Case Report: Osteoblastoma

- 69 yo male with 6yr Hx pain ant maxilla
  - Spontaneous, throbbing pain from #7 that radiated to R temporal-frontal region
  - + pulp response. + percussion. + PARL
  - OTC analgesics without effect
  - RCT had no effect on pain
  - Vertically angled PA moved lesion from apex
  - Sx biopsy revealed osteoblastoma

Ribera JOE 22:142, 1996
**Case Report: Osteoblastoma**

Ribera JOE 22:142, 1996

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**Neoplasia**

- Important features from case reports
  - Unusual radiographic lesions (i.e., multiple teeth with diffuse borders)
  - PARL with positive response to pulp testing
  - Subsequent paresthesia or anesthesia after dental tx
  - Lack of common etiologic factors
- Rare: Only 1.2% of 763 pts with non-specific jaw pain had metastases located in the mandible

Seltzer & Hargreaves, *in: Seltzer & Bender’s Dental Pain*, 2002

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**Non-Odontogenic Pain**

- Musculoskeletal
- Neuropathic
- Neurovascular
- Inflammatory Conditions
- Systemic Disorders
- Psychogenic (Somatoform Pain Disorder)

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**Psychogenic Pain (Somatoform Pain Disorder)**

- Consists of a cognitive perception of pain that has no demonstrable physical basis
- Dx should not be waste basket (i.e., exclusion)
  - Graff-Radford *DCNA* 35:155, 1991
- Four subtypes identified
  - Somatic delusions
  - Somatization disorder
  - Depression
  - Conversion

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**Psychogenic Pain (Somatoform Pain Disorder)**

- Differential Dx
  - Pain from multiple teeth
  - Pain that often shifts in location
  - Pain of long duration
  - Pain that crosses anatomical boundaries
  - No identifiable etiology
  - Pain that frequently changes perceptual character
Diagnosis of Non-Odontogenic Pain

• Be diligent in establishing a differential dx
• Reproduce the chief complaint
• Determine etiology of dental pain
• Consider all LA injections as diagnostic
  – Evaluate pt’s response
• Monitor Tx outcome
• Know your regional pain team
  – Pain dentists, neurologists, psychologists,
    radiologists, otolaryngologists