

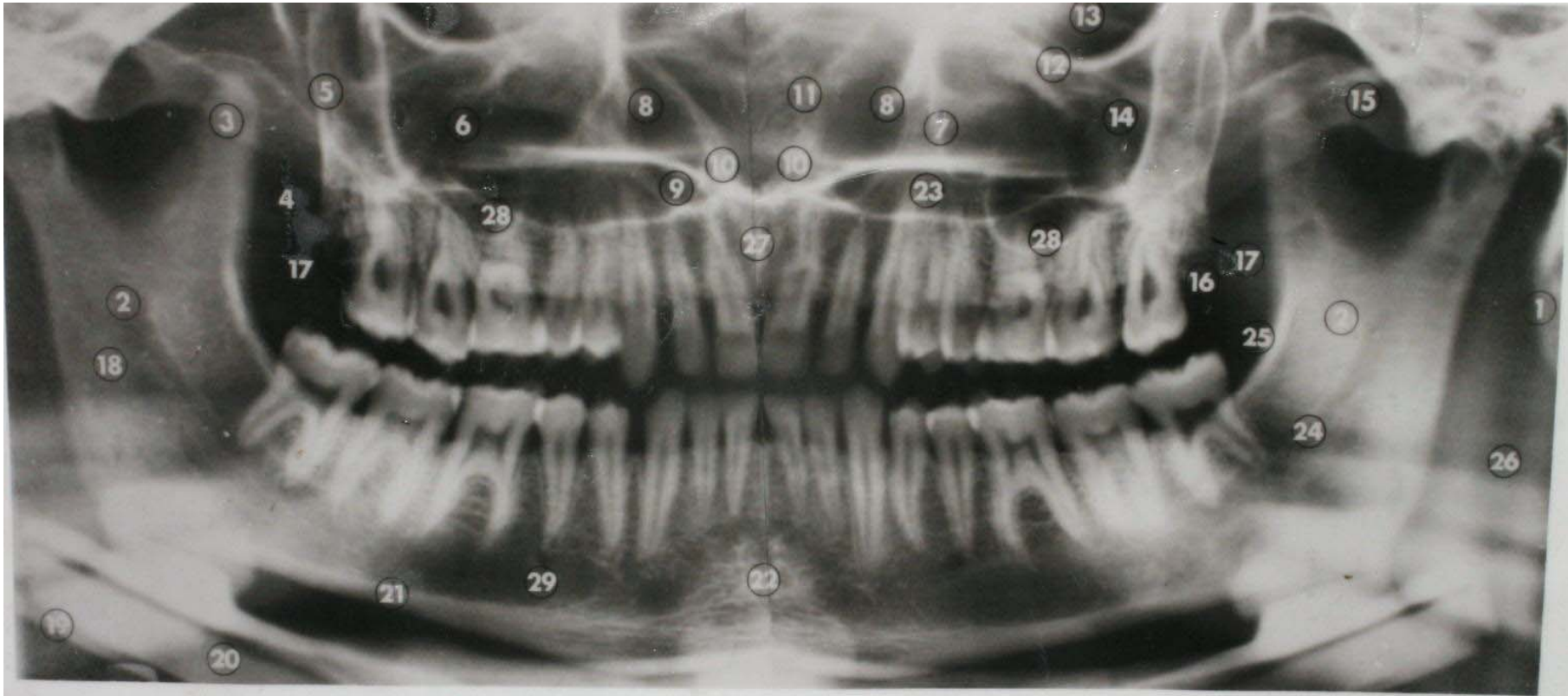
# Cavitations in the Jaw Bone, the Vagus Nerve and the Heart

Dietrich Klinghardt MD, PhD

Dallas June 2009



# Jaw: normal anatomy



- 1 MASTOID PROCESS
- 2 LINGULA
- 3 CORONOID PROCESS
- 4 LATERAL PTERYGOID PLATE
- 5 POSTERIOR WALL OF ANTRUM
- 6 ANTRUM (maxillary sinus)
- 7 ANTEROMEDIAL WALL OF ANTRUM
- 8 INFERIOR CONCHA
- 9 FLOOR OF NASAL FOSSA
- 10 ANTERIOR NASAL SPINE

- 11 NASAL SEPTUM
- 12 INFRAORBITAL RIDGE
- 13 ORBITAL CAVITY
- 14 MALAR PROCESS
- 15 ZYGOMATIC ARCH
- 16 MAXILLARY TUBEROSITY
- 17 HAMULUS
- 18 RAMUS
- 19 SUPERIMPOSITION OF LEFT SIDE OF CHIN REST

- 20 CHIN REST
- 21 INFERIOR BORDER OF MANDIBLE
- 22 MENTAL PROTUBERANCE
- 23 HARD PALATE
- 24 MANDIBULAR CANAL
- 25 INTERNAL OBLIQUE LINE
- 26 SUPERIMPOSITION OF RIGHT JAW
- 27 INCISIVE CANALS
- 28 FLOOR OF ANTRUM
- 29 MENTAL FORAMEN



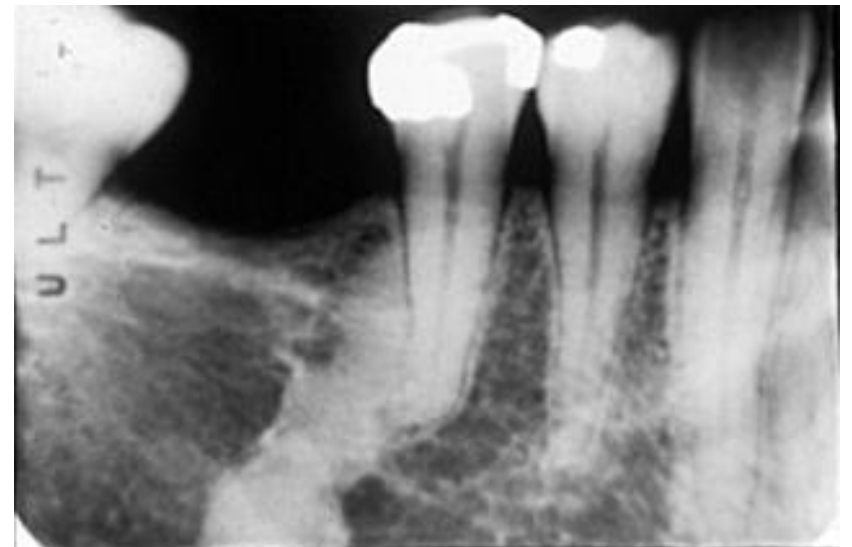
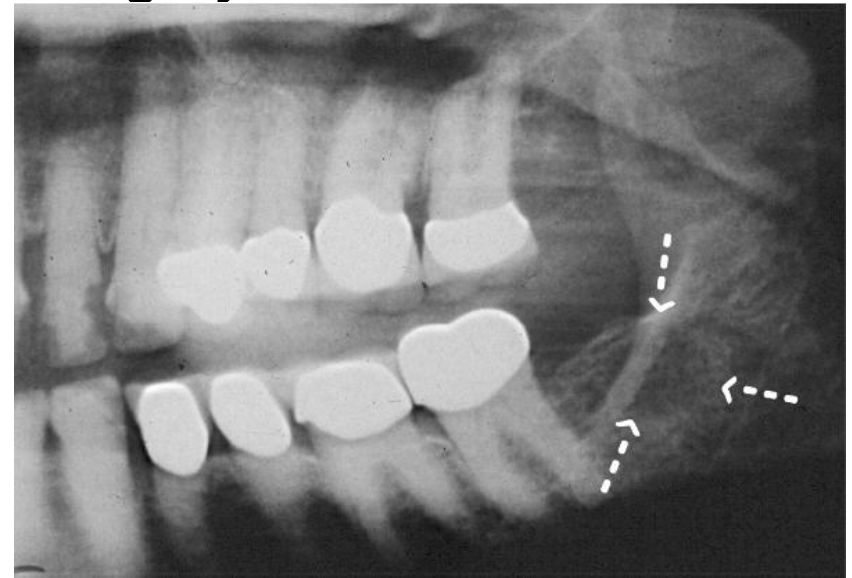
# Normal Bone



No discoloration; nerve is white/yellow and glistening; small hollow spaces (<5 mm.) may be seen; no soft bone; no large (> 5 mm.) hollow spaces.

# Retromolar and molar cavitations

*Patient with CFIDs and Lyme carditis, resolved with cavitation surgery*



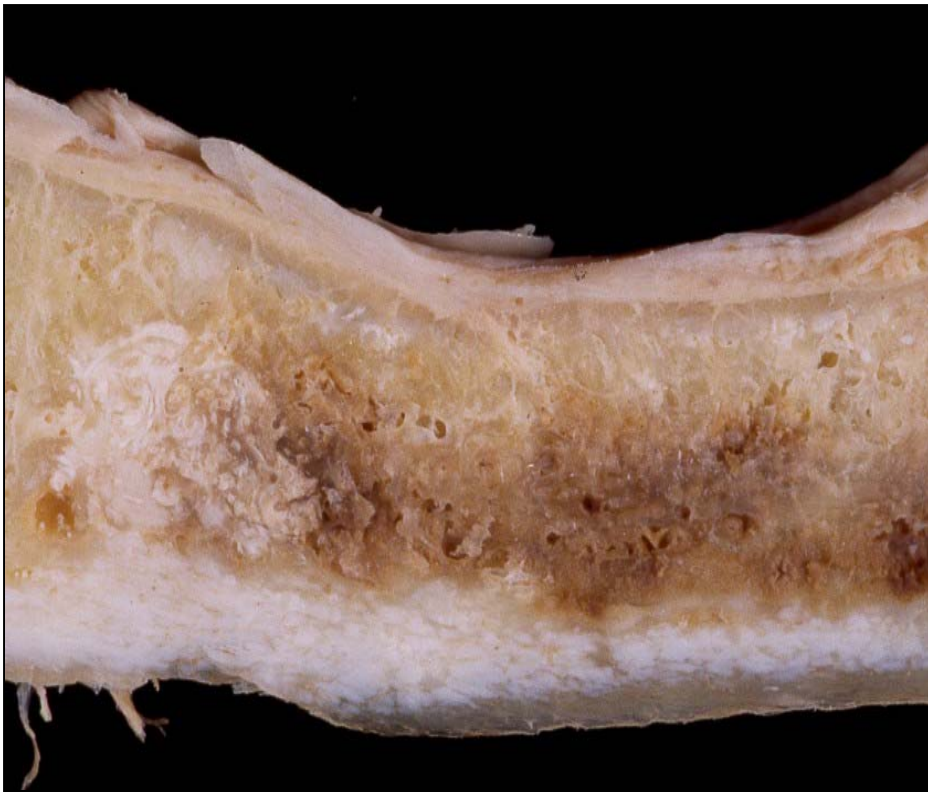
# What are cavitations and why worry?

- Cavities are holes in the teeth
- Cavitations are holes or areas of low density in the jaw bone
- Cavitations have been shown to cause
  - a. local problems:
    - **trigeminal neuralgia**
    - **atypical facial pain**
    - **persistent local pain**
    - **spread of stealth infection to neighboring teeth (with ever increasing number of root fillings or tooth extractions)**
  - b. referred, distant problems:
    - **Joint degeneration (esp. large joints: hip, knee and shoulder)**
    - **Organ and systems deterioration with a large variety of pathological findings:**
      - Heart: cardiomyopathy, coronary heart disease, arrhythmias**
      - Brain: CFIDS, FMS, MCS, AD, diffuse vessel disease, areas of hypoperfusion and/or hypometabolism, psychiatric and emotional disorders**
      - Chronic liver disease (symptomatic Hep.C, fatty degeneration, impaired detoxification, stasis of the bile system)**
      - All flavors of kidney disease**
      - Immune system breakdown with chronic infections (HHV-6, Lyme disease, mycoplasma), fatigue, cancer**
      - Intestinal problems: leaky gut, recurrent parasitosis, Crohn's disease, ulcerative colitis**



# Normal v. Disease

To know disease, one must first know  
that it is different from normal



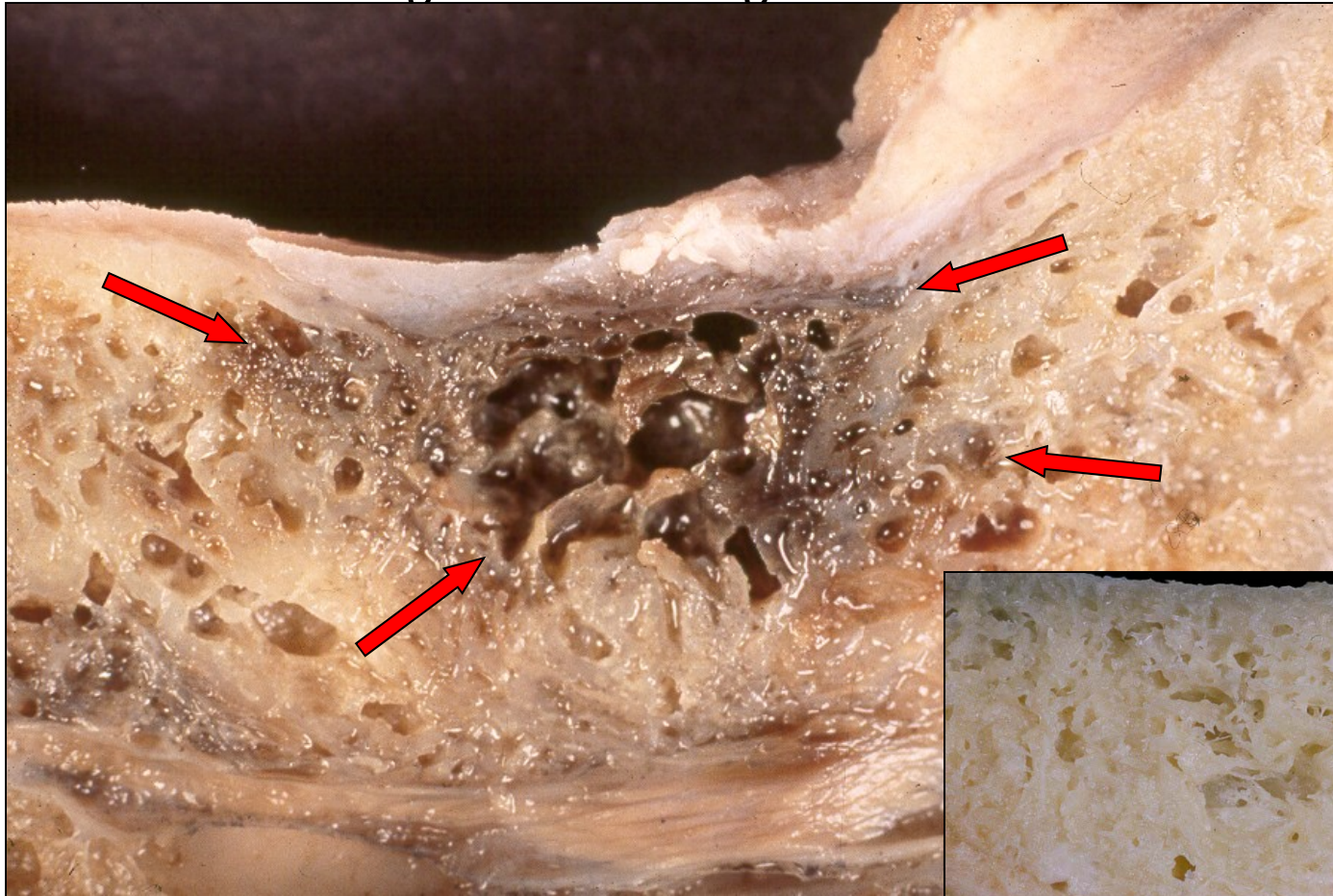
Ischemic bone disease



Normal bone

# Maxillofacial Osteonecrosis

Chronic Ischemic Bone Disease: *patient committed suicide with chronic trigeminal neuralgia. He dedicated his skull to science*



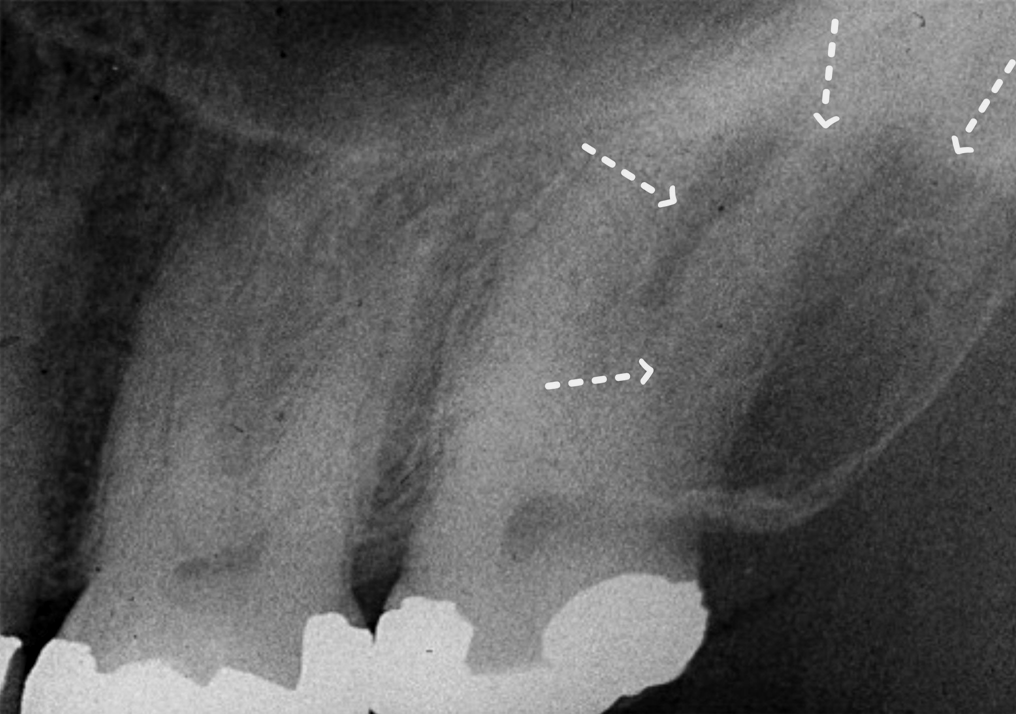
Normal bone.

Multicystic, discolored "mush" of posterior mandible in patient with atypical facial neuralgia/pain

Photo: J Oral Pathol Med 1999; 28:423.







It can be difficult to image, but can usually be seen on a good quality radiograph: *patient with MCS, greatly improved with cavitation surgery*

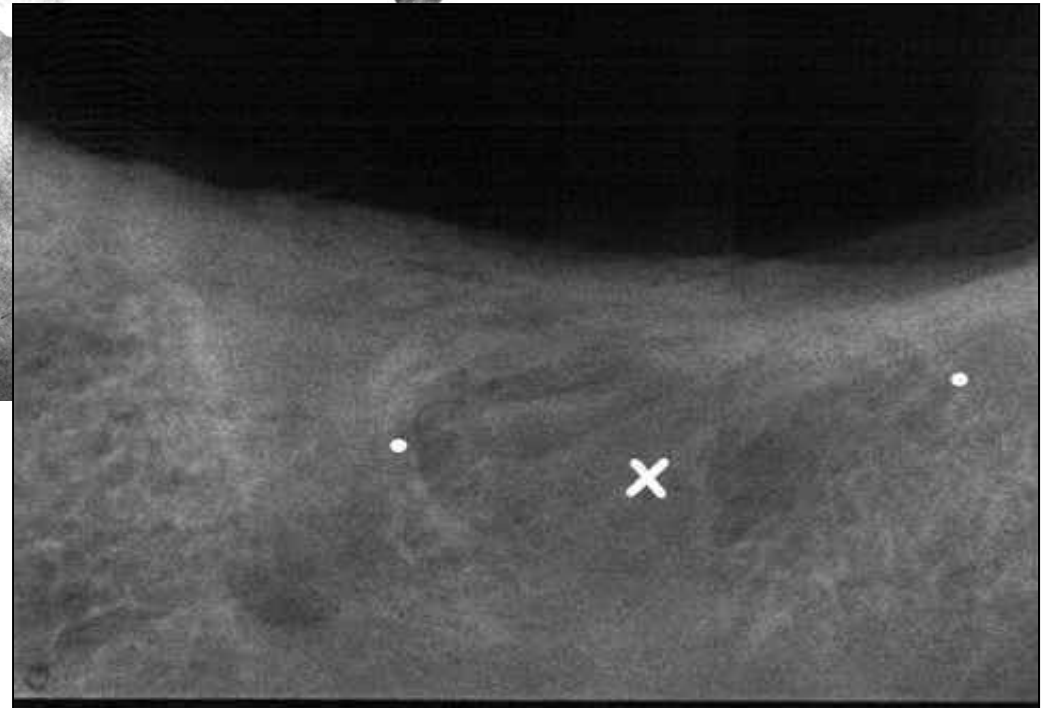
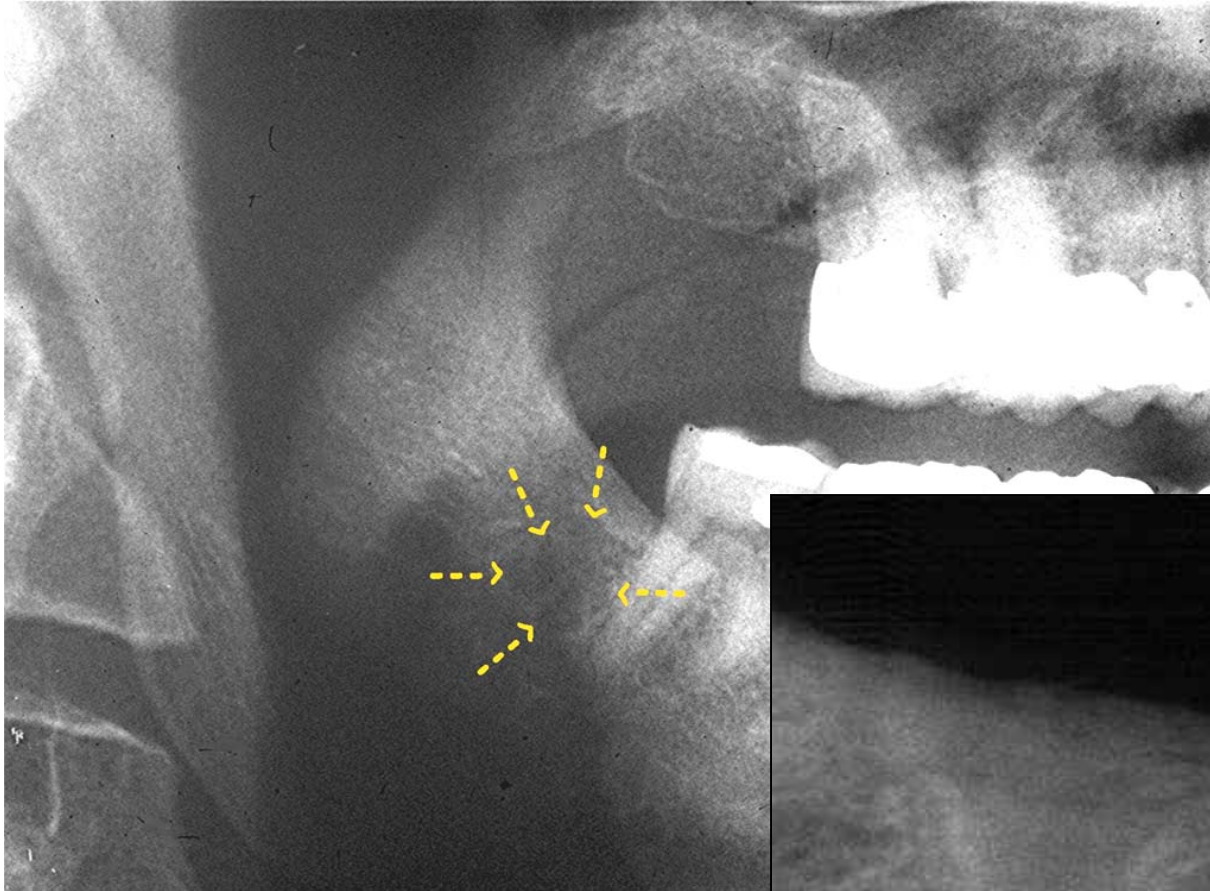


**More than 50% of cancellous bone can be lost before the image is apparent on x-rays**

***Patient with atrial fibrillation, resolved with cavitation surgery***

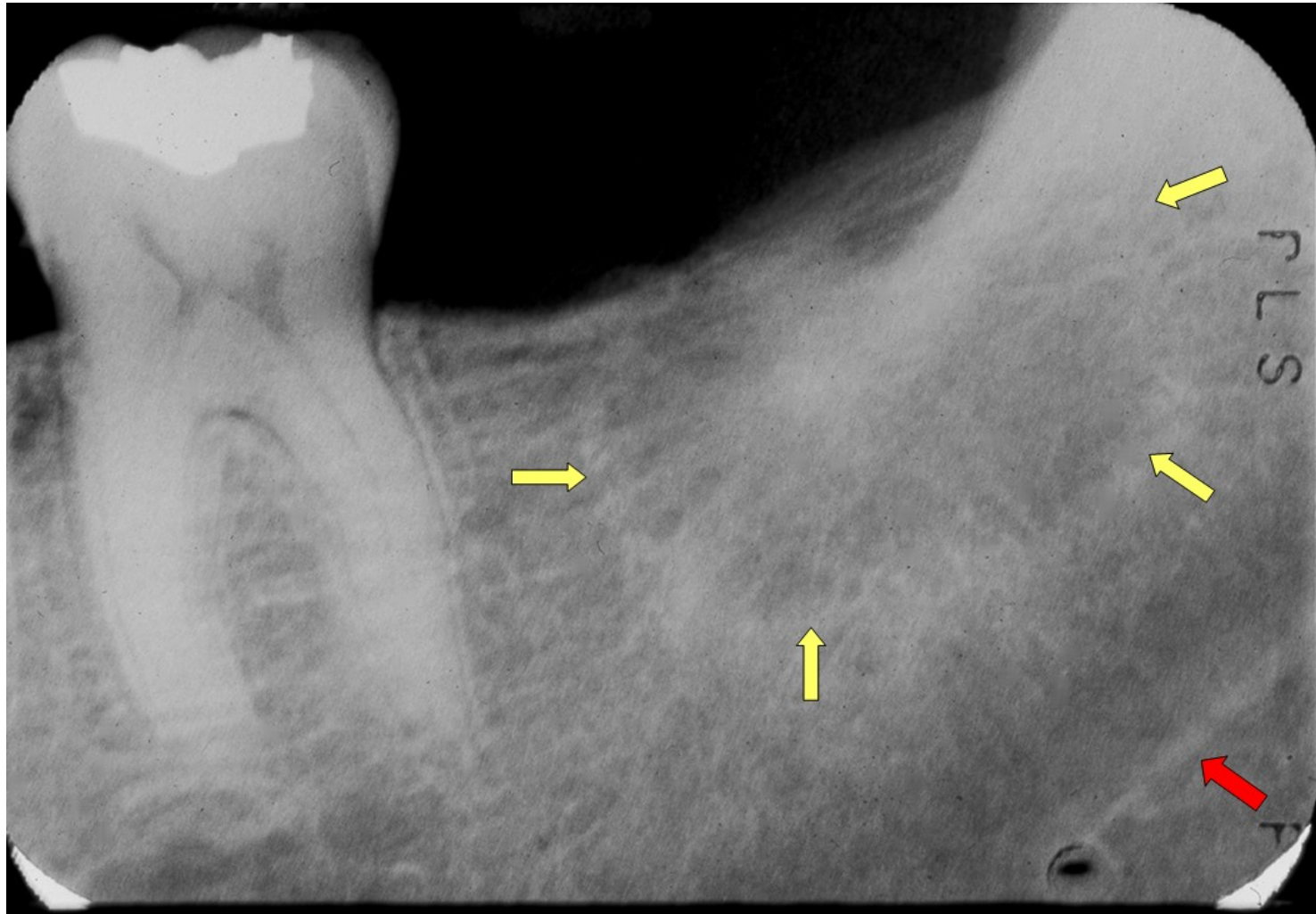
RS = Residual socket

# Regional Ischemic Osteoporosis: *patient with angina, resolved with cavitation surgery*



# “Eagle’s Nest Lesion”

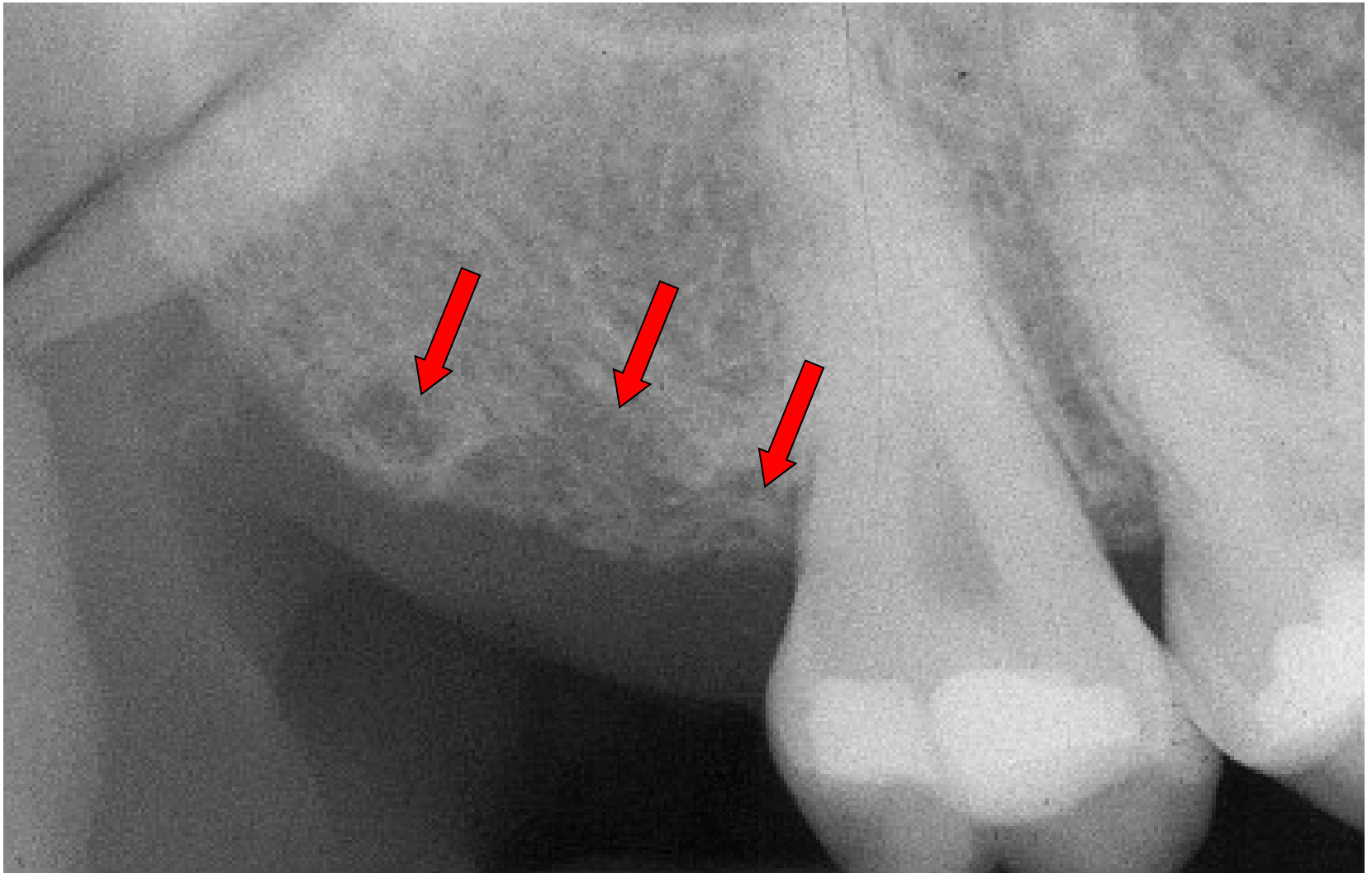
*Poor Healing of Infarct*



Calcification along vessels radiating from the center commences, but no further maturation or remodeling. May remain this way for years. Red arrow indicates intact lower wall of the inferior canal; top wall has been destroyed.

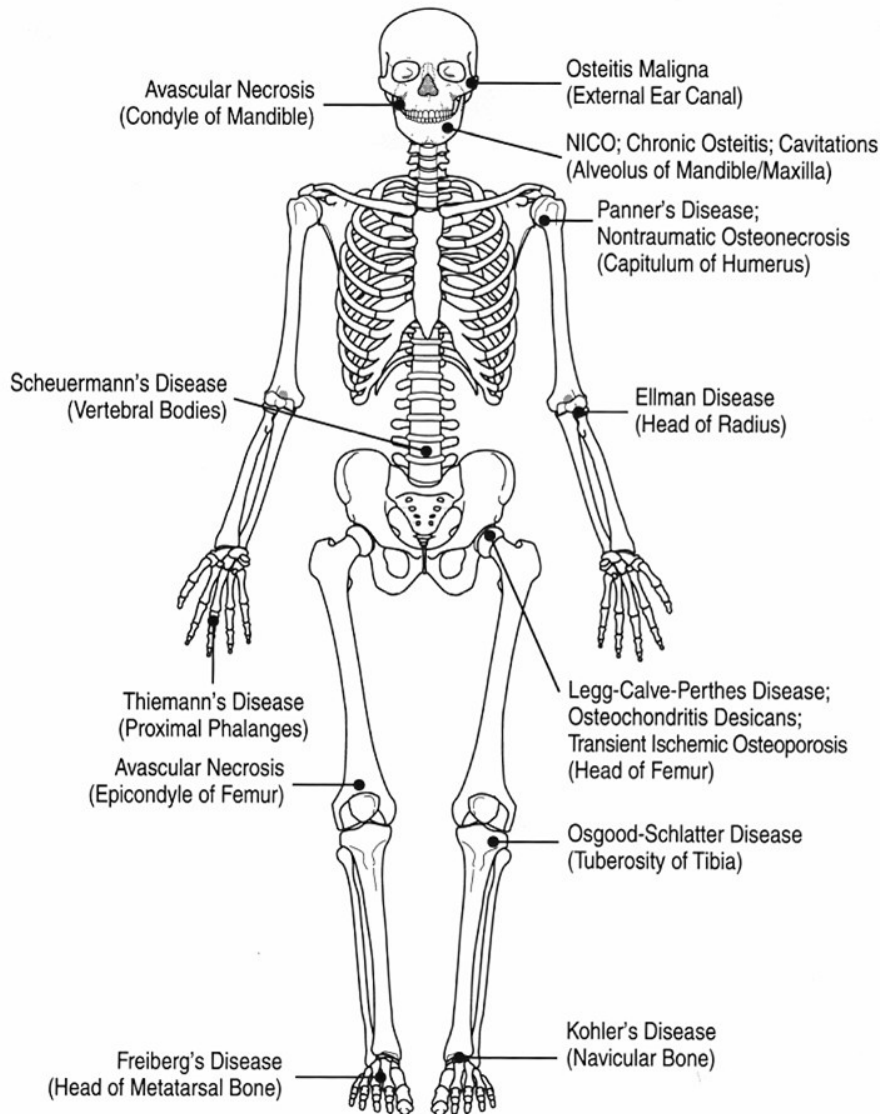


## “Moth-eaten” Radiolucency



**Arrows point to areas of irregular bone destruction. Cortex was missing over much of the lesion. *Patient with malabsorption, leaky gut and LAD stenosis. Improved after surgery. Stable for 9 years***

## ISCHEMIC OSTEONECROSIS



# ISCHEMIC BONE DISEASE

- ❑ Can occur in every bone in humans
- ❑ Usually: hip, jaws, knees
- ❑ Affects any age
- ❑ Affects both genders
- ❑ May or may not be painful
- ❑ May be mild or severe
- ❑ Many “trigger events”
- ❑ Symptoms may appear over a period of many years

## Making the Diagnosis

- Good quality panorex radiograph and good interpretation technique
- Patient history: FM, CFS, heart arrhythmias, back pain, TMJ pain, neuralgias, history of infection or dry socket when tooth was extracted, illnesses beginning a short time after dental work
- Clinical exam: Perio probings, root canals (look for residual radiolucencies), sclerosis, incomplete fills, overfills, perforations, root resorption, non-vital teeth (EPT), radiolucencies, areas painful to palpation, mild tissue edema, chronic sore throat, chronic sinusitis
- Anesthetic Localization



# Anesthetic Localization and Confirmation



The anesthetic localization procedure is an aid in ruling out or confirming suspected primary sources of oral or dental pain.

*Ronald S. Brown, et. al., JADA, Vol. 126, May 1995*

Use a few drops of 1-3% procaine at apex of tooth in question.

# Radiologic Diagnosis

(listed in order of frequency in 500 patients with jaw pain)

- Poorly demarcated radiolucency
- Moth-eaten radiolucency
- Irregular vertical trabeculae in edentulous area (laminar rain)
- Eagle's nest radiolucency
- Focal destruction of the mandibular canal
- Soap bubble radiolucency
- Horizontal trabeculae
- Focal destruction of wall of maxillary sinus
- Focal destruction of cortical alveolar bone
- Radiopaque flecks
- Cotton-wool radiopacities

# OTHER IMAGING TECHNIQUES

- TECHNETIUM 99 SCAN
- NEWTOM SCAN
- VOLUMETRIC CT SCAN
- ICAT SCAN



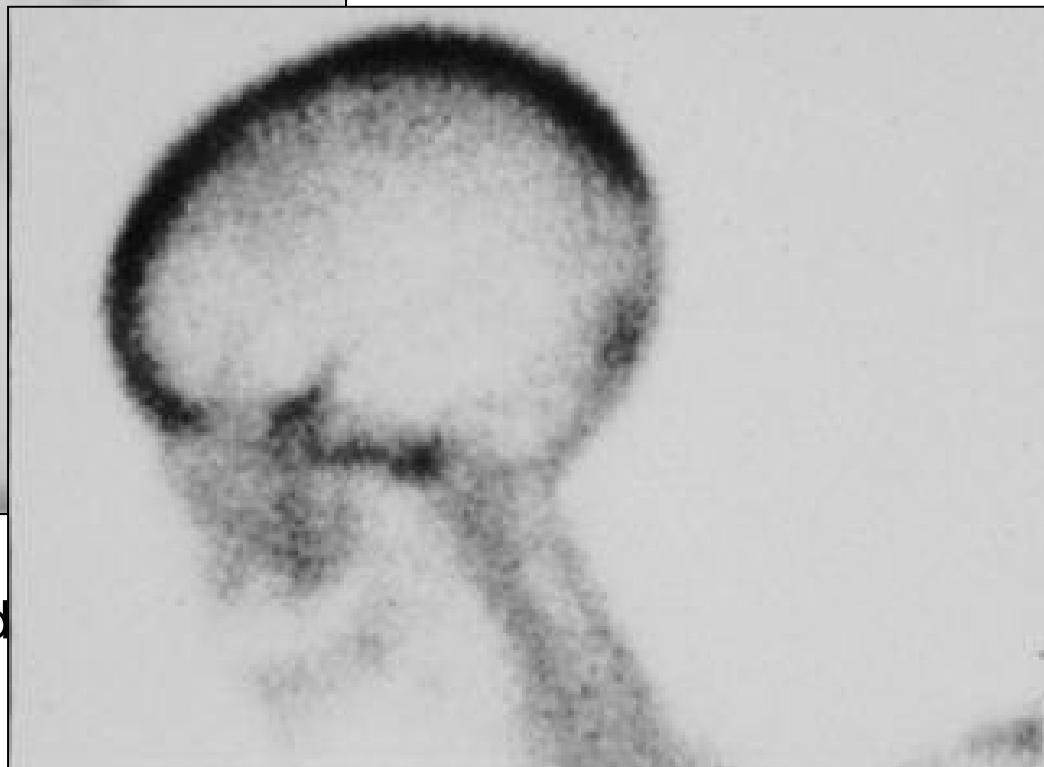
# Technetium 99m MDP Scans

The Disease is not Always in the Jaws

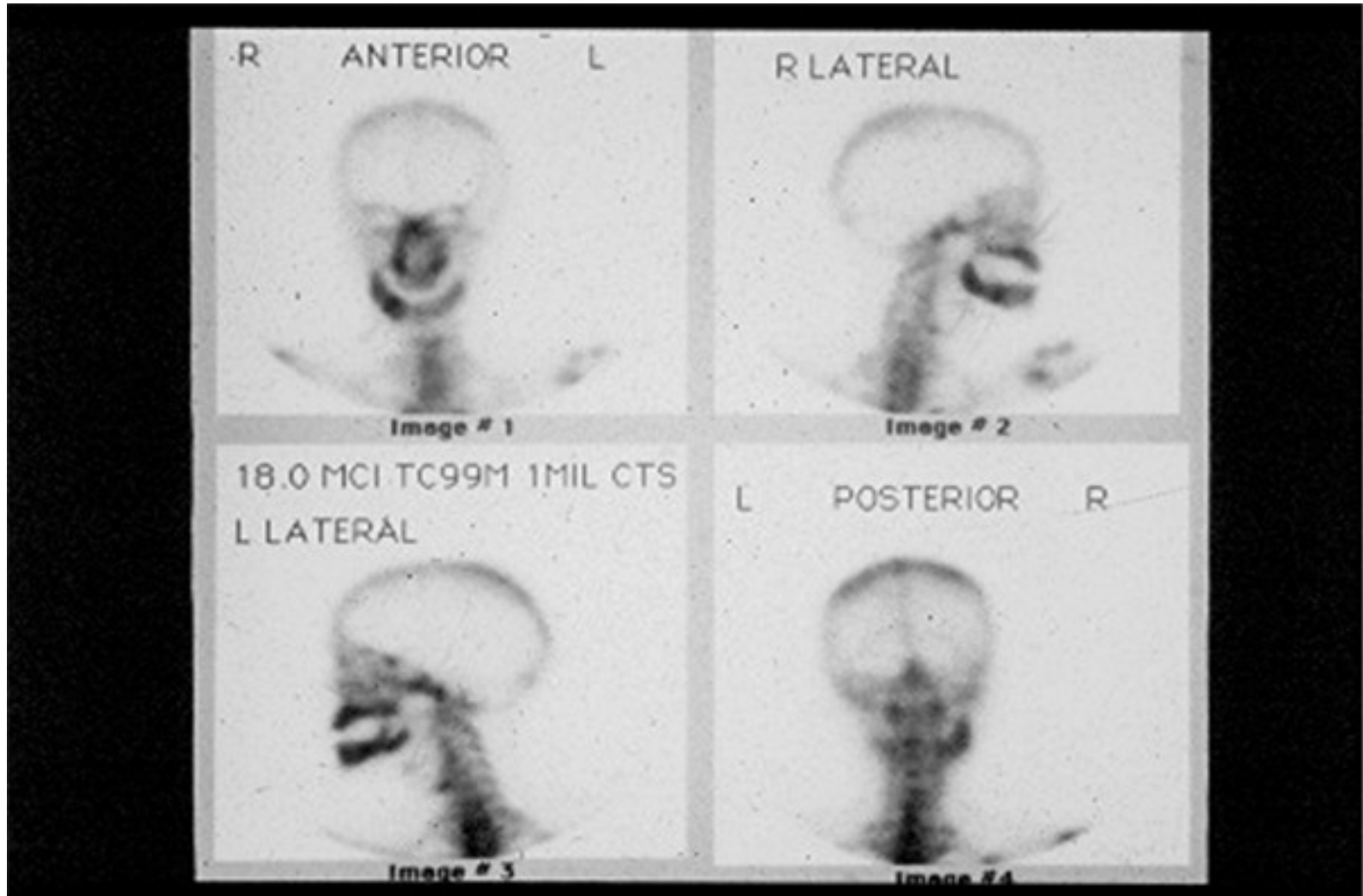


Above: Massive involvement of both jaws and the sphenoid sinus in trigeminal neuralgia patient.

Below: Jaws are negative but skull is hot. In patient with chronic headache.



# Technetium 99 MDP



**Dark “hot spots” indicate diseased bone in patient with atypical facial neuralgia/pain.**

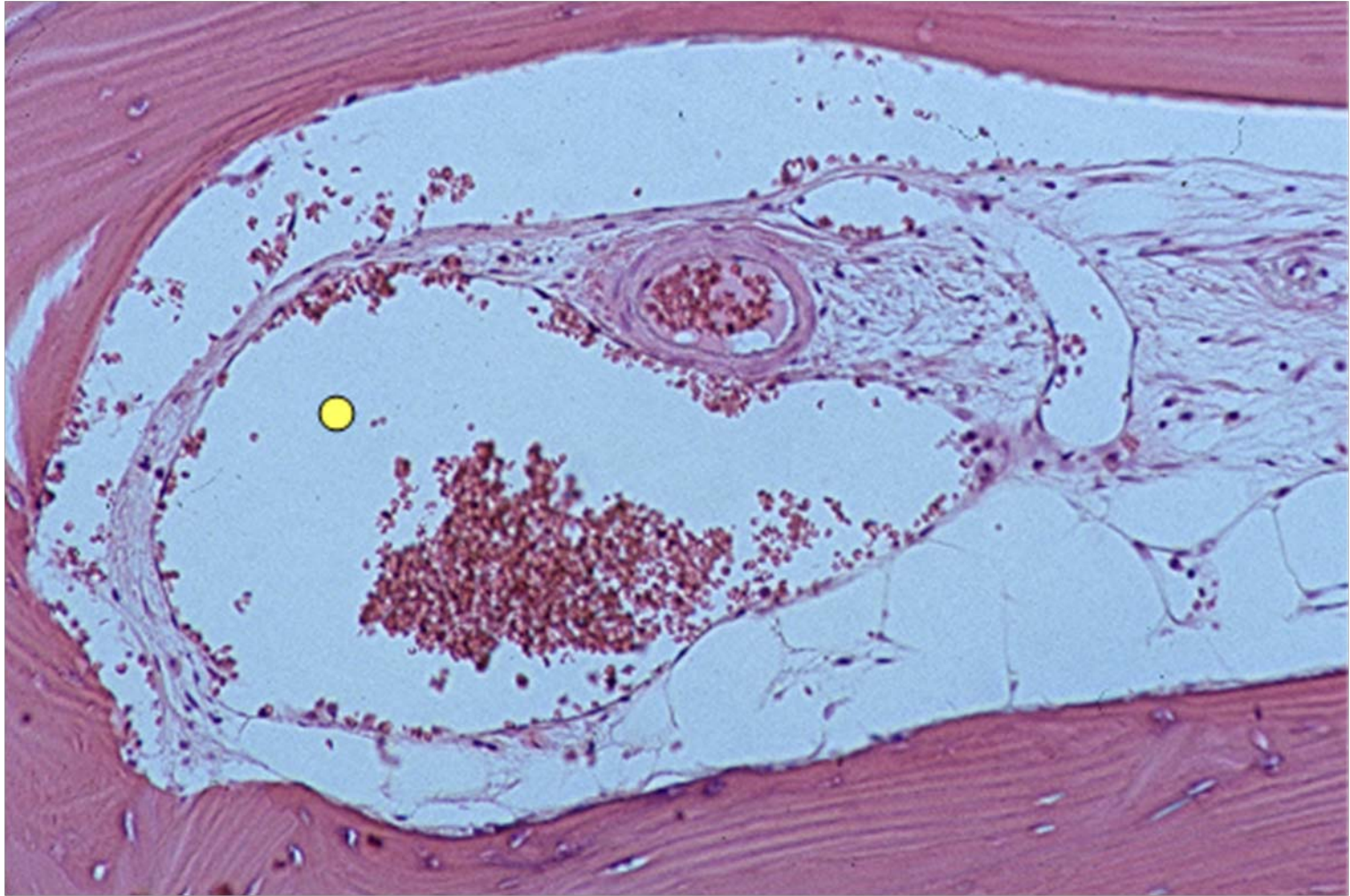
# Unique Microscopic Features

As Per the Orthopedic Literature

- Myelofibrosis (streaming fibers between adipocytes)
- Dilated marrow capillaries and sinusoids
- Plasmotasis (serous ooze)
- Microinfarction and thrombosis
- Prominent & excess cement lines
- Microcracks along cement lines
- Oil cysts & fat microvesicles (liquid fat globules)
- Calcific necrotic marrow debris (detritus)

# Marrow Vessels Become Dilated

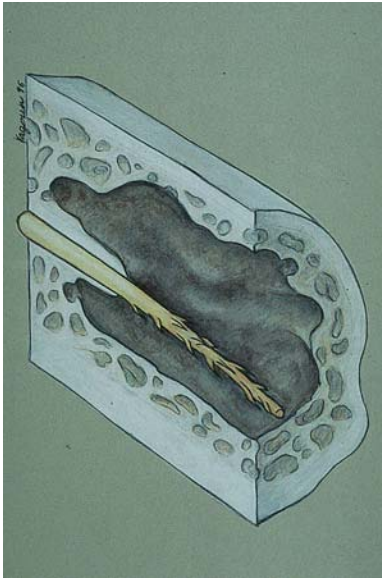
From Backup Pressures, Bone Marrow Edema



Most marrow arterioles have two small veins following them. 80% of osteonecrosis cases have poor outflow, and when pressures slowly build the veins distend more than the arterioles. Compare a normal vein (yellow dot) to the dilated one here.



# Ischemic Jawbone Disease can be very painful



- ❑ Osteonecrosis is painful in 2/3 of all cases, regardless of bone
- ❑ Only in the jaws are major sensory nerves found within the marrow spaces
- ❑ Myelin degeneration has been shown in some cavitation patients
- ❑ Anti-peripheral nerve antibodies are circulating in blood of at least some patients with cavitations
- ❑ Toxins can be transported to gasserian ganglion

# Abnormal Blood Markers for Chronic Inflammation in Patients with CHD

- High sensitivity CRP > 10 mg/L
- Cycl-oxygenase 2 (COX-2)
- HDL cholesterol (inversely related to dental disease)
- Erythrocyte Sedimentation Rate
- Fibrinogen
- Tryglicerides
- Leucocyte count
- Helicobacter pylori IgG and IgA
- Chlamydia IgG and Iga
- IL-2beta

In a study by Meurman et al, there was a positive correlation between dental infections and these serum inflammatory markers. The patients with high serum inflammatory markers also had a higher incidence of coronary heart disease.

Dental Infections and serum inflammatory markers in patients with and without severe heart disease, *Oral Surg Oral Med Oral Path Oral Radiol endod* 2003; 96:695-700.

*Beck et. Al. , Oral disease, cardiovascular disease and systemic inflammation.  
Periodontology 2000;23:110-20*

- Proposed that periodontal disease and atherosclerosis may share a similar causative pathway
- Certain individuals may be more likely to respond than others with higher levels of inflammatory stimuli



Haraszthy et al using PCR assay detected periodontal pathogens in 44% of 50 **carotid** endarterectomy specimens.

Dorn et al and Progulsk-Fox et al showed that Porphyromonas gingivalis could invade human **coronary artery** cells in cell cultures.

# Treatment of Radiolucent Lesions

The only accepted curative therapy is surgery followed by an appropriate antibiotic regimen.

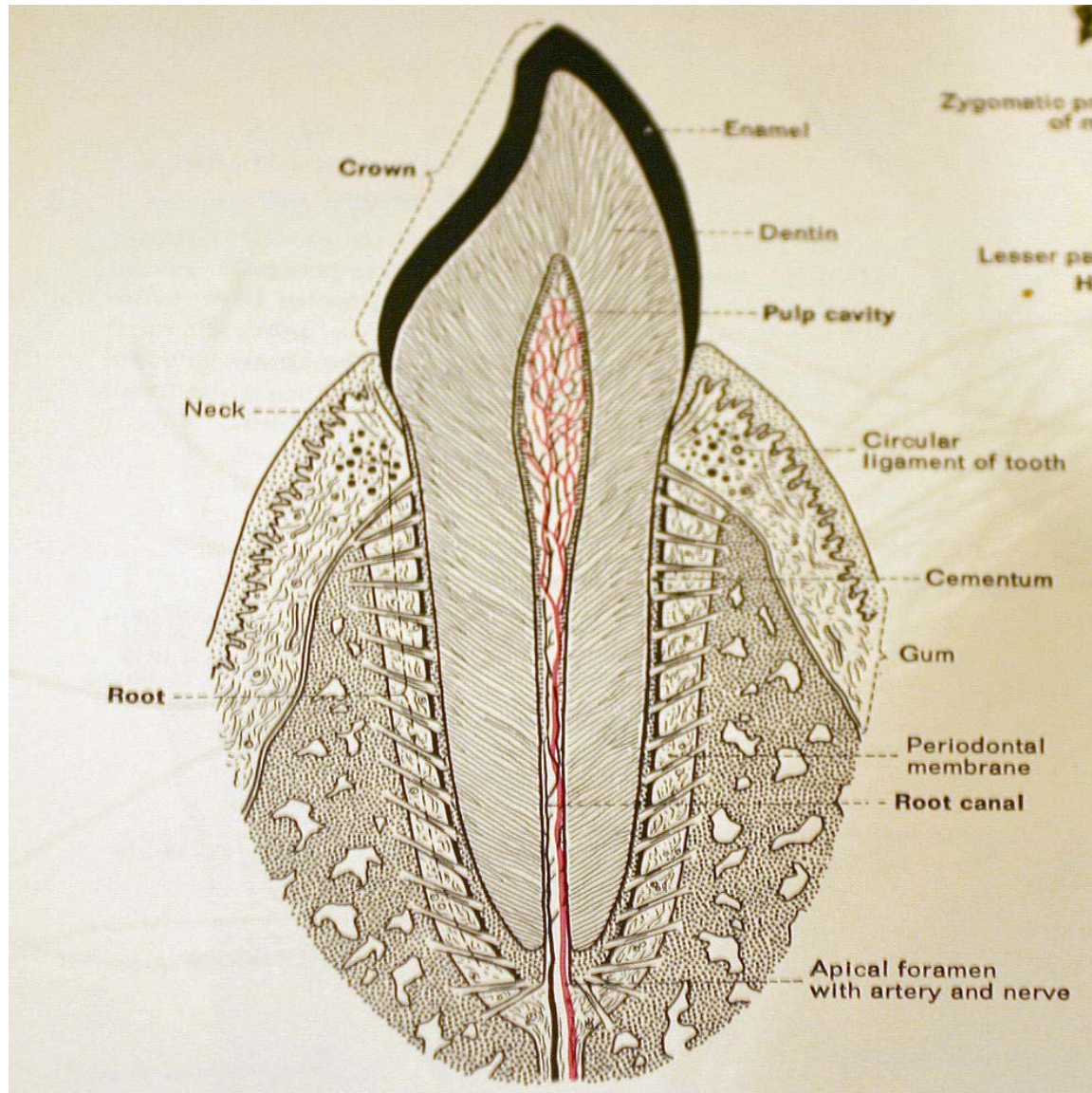
This is the standard of care in the orthopedic textbooks

D.Klinghardt and A.Elmajian (1991) adopted a dental intraosseous injection technique and injected ozone into the jaw bone at the site of a lesion with significant improvement. P.Mollica et al perfected the procedure, which is currently undergoing an IRB approved large cohort study. The results are promising so far.

# Root Canals (Dead Teeth)

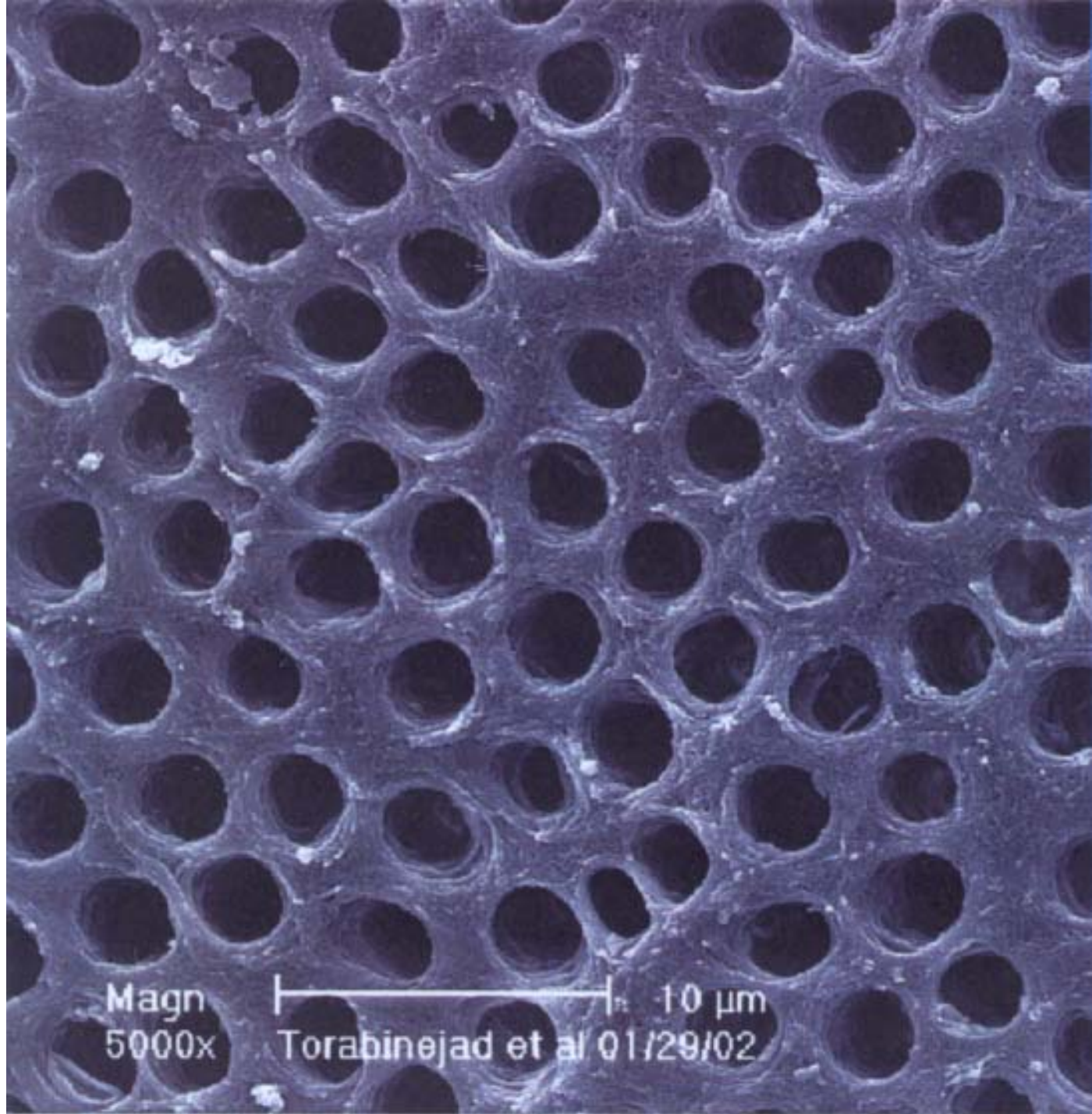
- A root canal is done when a tooth is dead or abscessed.
- The nerve and blood supply are removed and an “inert” filling material is put in its place.
- This material is gutta percha sealed in the tooth with a paste that is usually antimicrobial in nature.

**There are 30,000 to 75,000 microscopic dentinal Tubules per square millimeter.**



**These tubules cannot be filled and can harbour millions of anaerobic bacteria. Endotoxins produced by these bacteria can cause a chronic inflammation of the surrounding bone.**



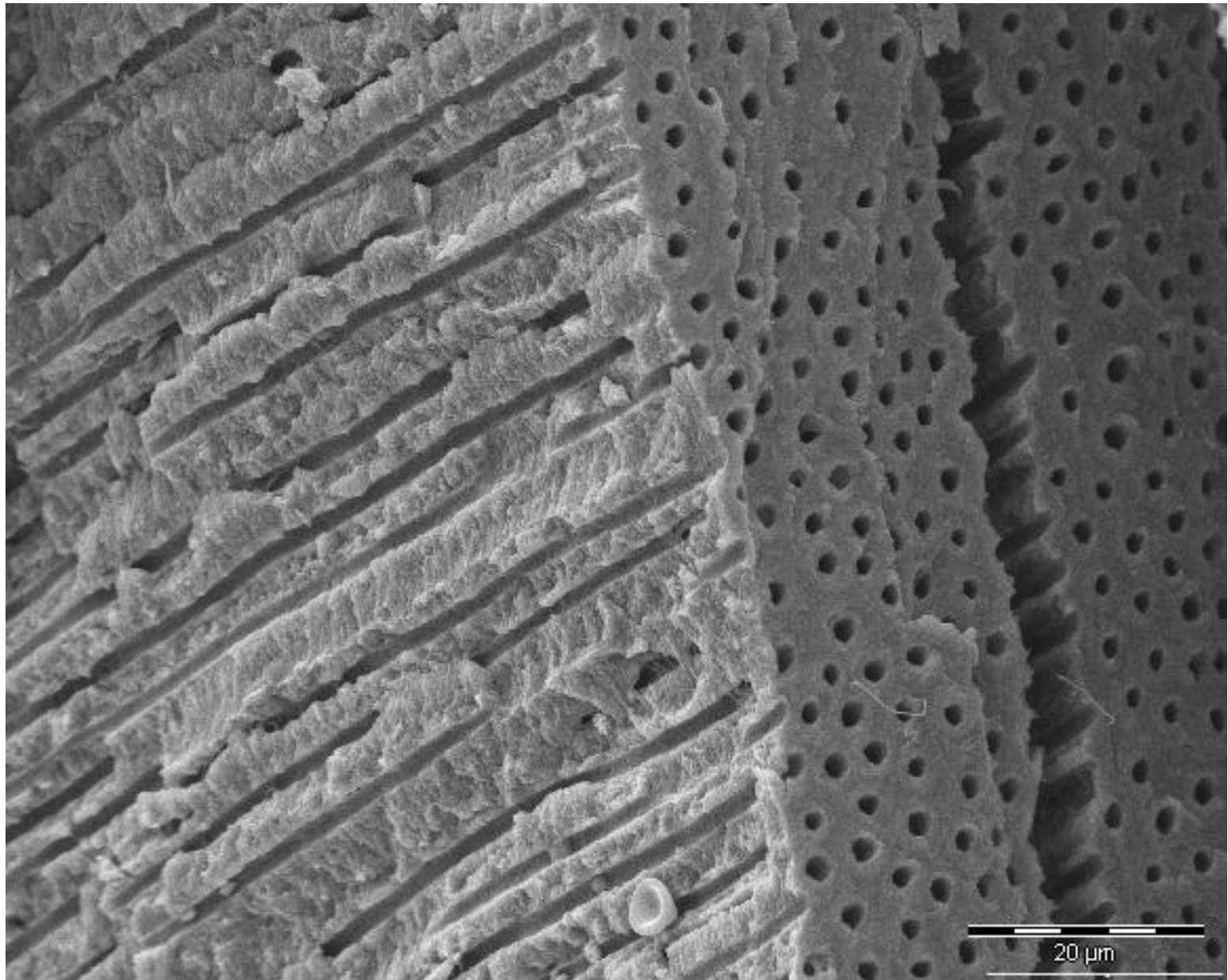


Magn  
5000x

10  $\mu$ m

Torabinejad et al 01/29/02





# Why root canals don't work



- The infected dentinal tubules are left untreated
- The infected bone is left untreated
- 80% of extracted root canals when examined in cross-section are incomplete obturations

# Endodontics in the era of evidenced-based practice

*Oral Surgery, Oral Medicine, Oral Pathology, November 2003*

Even though an alarmingly high rate of endodontic failures is found in cross-sectional clinical populations studies, endodontic education is being constricted rather than expanded.

J.F. Siqueira, et. al., Polymerase chain reaction-based analysis of microorganisms associated with failed endodontic treatment,  
Oral Surg Oral Med Oral Pathol Oral Radiol Endod  
2004; 97: 85-94

Microorganisms occurred in all cases of root-filled teeth associated with periradicular lesions, which lends strong support to the assertion that treatment failures are of infectious etiology, caused by persistent infections. *E. faecalis* was by far the most prevalent species.

## Radiographic appearance of an abscessed tooth (periapical lesion)



## Microscopic appearance of a periapical abscess.





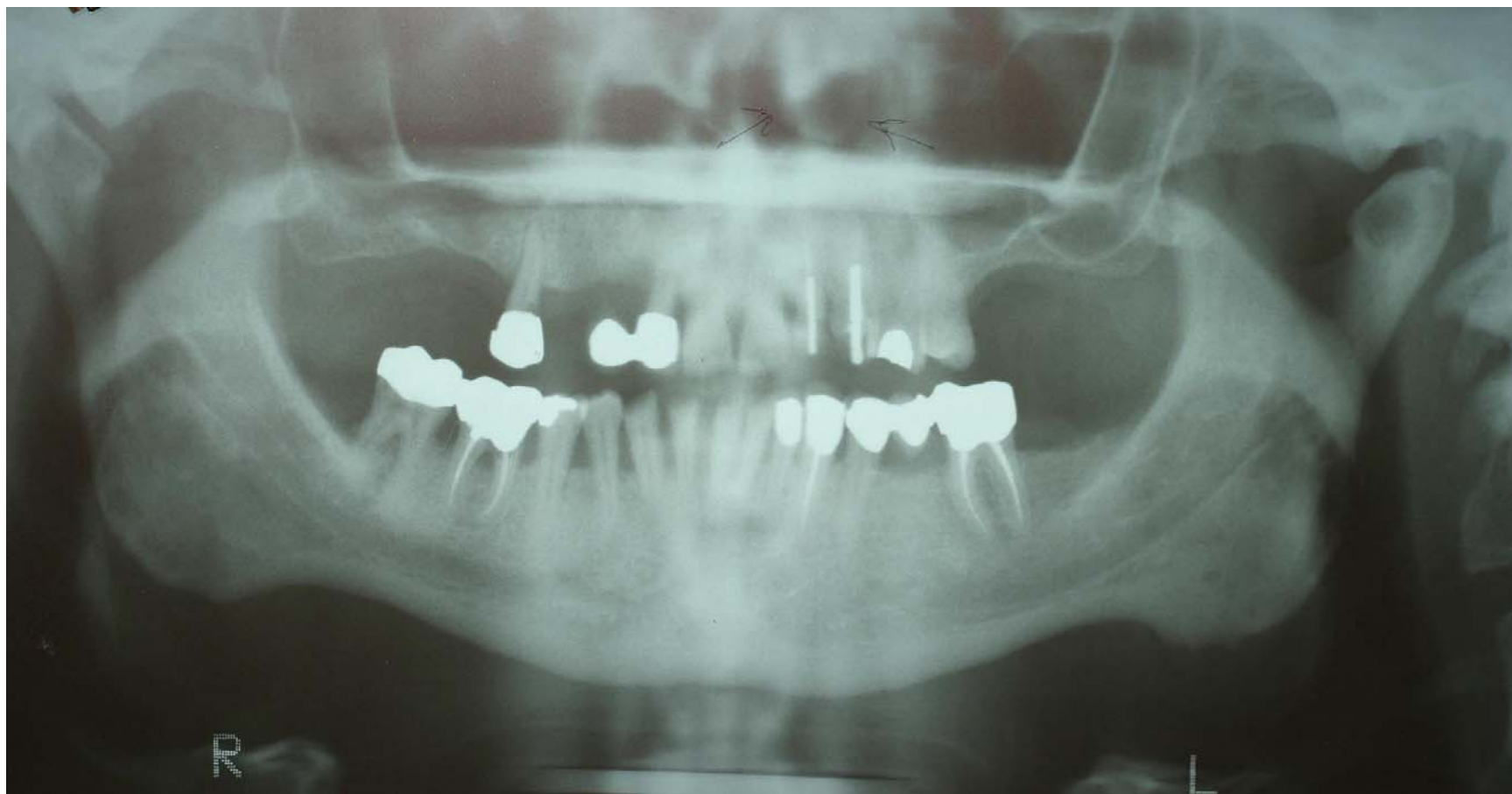
NM Chugal, et. al., Endodontic infection: Some biologic and treatment factors associated with outcome  
*Oral Surg., Oral Medicine, Oral Path., July 2003, Vol. 96, No. 1.*

By far, the presence and the extent of a preoperative **periapical lesion** had the strongest negative effect on endodontic outcome

JF Siquiera, et. al.; A Scanning Electron Microscopic Evaluation of In Vitro Dentinal Tubules Penetration by selected Anaerobic Bacteria,  
*Journal of Endodontics, June 1996, Vol. 22, No. 6*

The results indicated that all bacterial strains tested were able to penetrate into dentinal tubules....persistent infection may be caused by microorganisms that have invaded dentinal tubules before or during endodontic treatment. Root canal walls were heavily infected with *E. faecalis*.....

Patient with diagnosed cardiomyopathy, rapid deterioration since 8 months. Good improvement over 3 year follow up after extraction of all root filled teeth and curettage of adjacent jaw bone



38 y.o. female Patient with atrial fib of „unknown origin“

Full recovery after amalgam removal and detox program



## Mercury toxicity causing „viral cardiomyopathy

**Full recovery after amalgam removal and working a detox protocol with EDTA, DMSA and MicroSilica**





## Rubberdam



## Swedish suction device



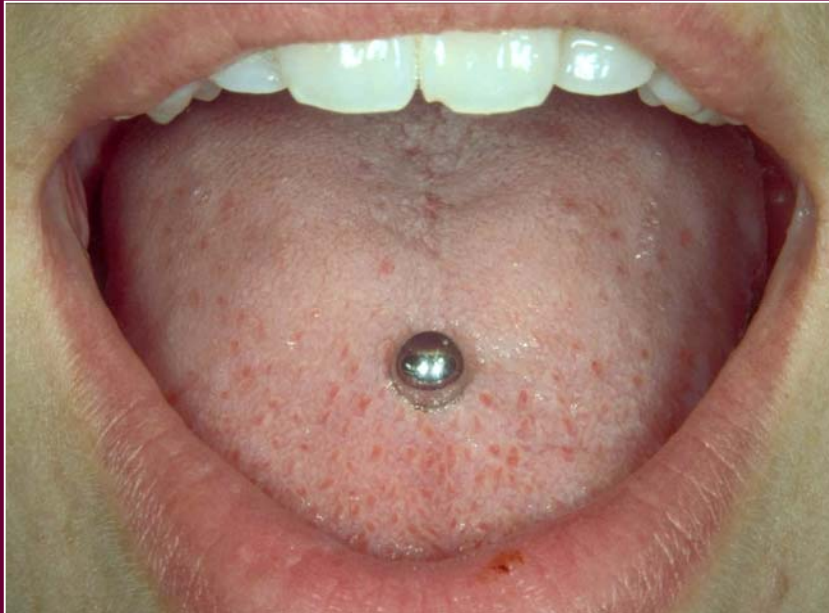
# Mercury from amalgam fillings

This is Mercury  
escaping from an  
amalgam filling.  
The filling is 50  
years old. The  
tooth was  
extracted 15  
years ago.



**17 y.o with frequent bouts of fainting and supraventricular arrhythmias**

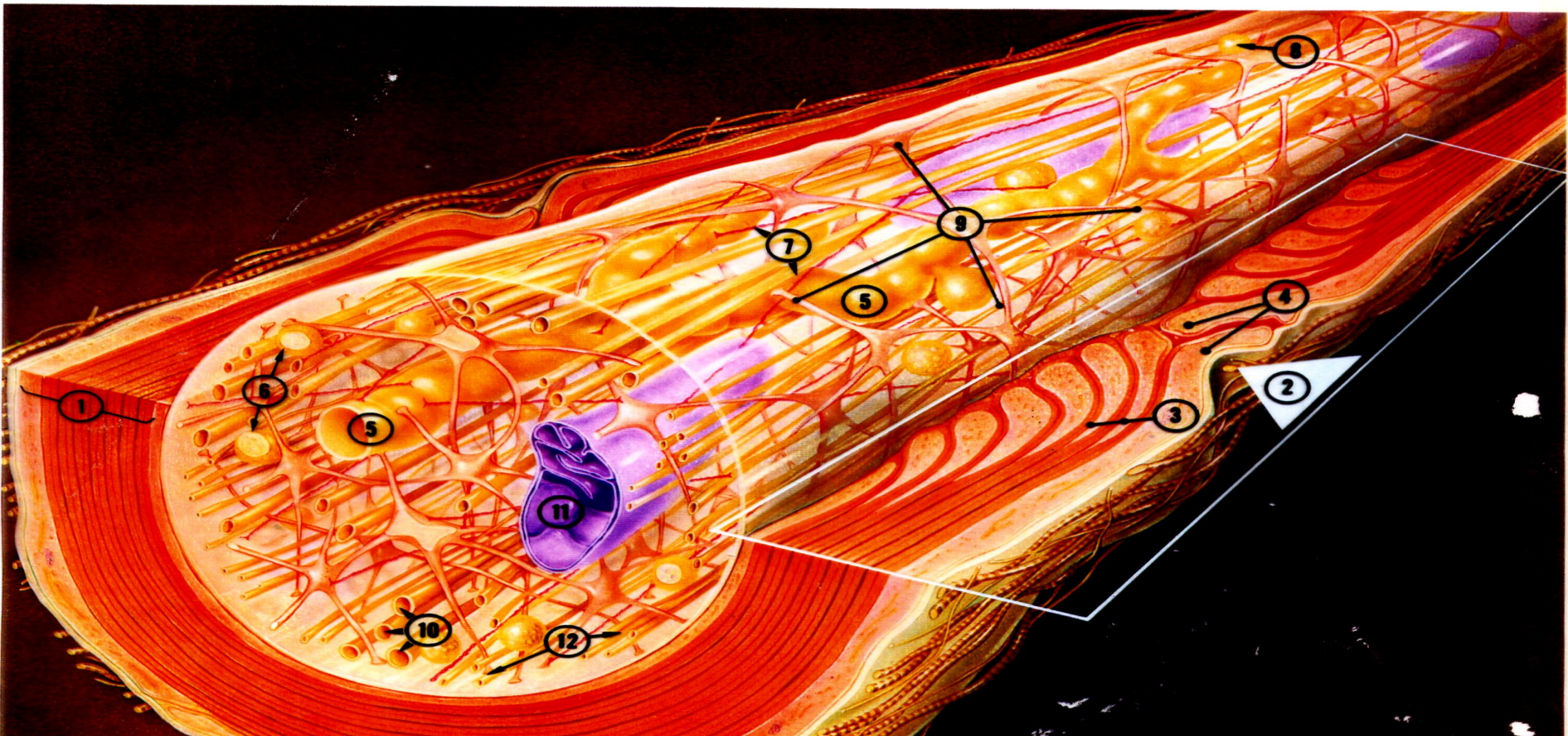
**„Cured“ after 6 weeks of metal removal**





- Viruses, bacteria, biotoxins and metals travel upstream inside the nerves (retrograde axonal transport)

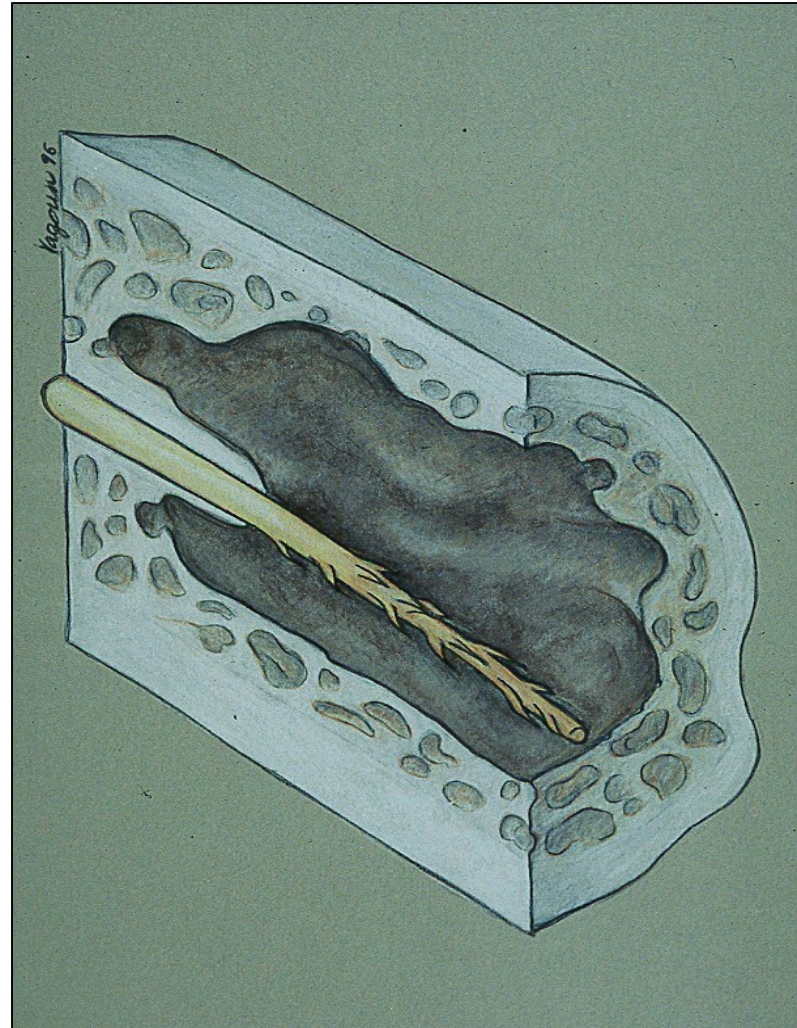
- |                                    |                            |
|------------------------------------|----------------------------|
| ① Markscheide                      | ⑥ Neurotransmitter-Bläsche |
| ② Ranvierscher Knoten              | ⑦ Mikrofilamente (Actin)   |
| ③ Schmidt-Lantermannsche Inzisuren | ⑧ Lysosom                  |
| ④ Fortsätze der Schwann-Zellen     | ⑨ Mikrotrabekel-System     |
| ⑤ Axoplasmatisches Retikulum       | ⑩ Mikrotubuli              |
|                                    | ⑪ Mitochondrium            |
|                                    | ⑫ Neurofilament            |





# Ischemic Cavitation

“Dry Rot” from Desiccation, with Frayed Nerve

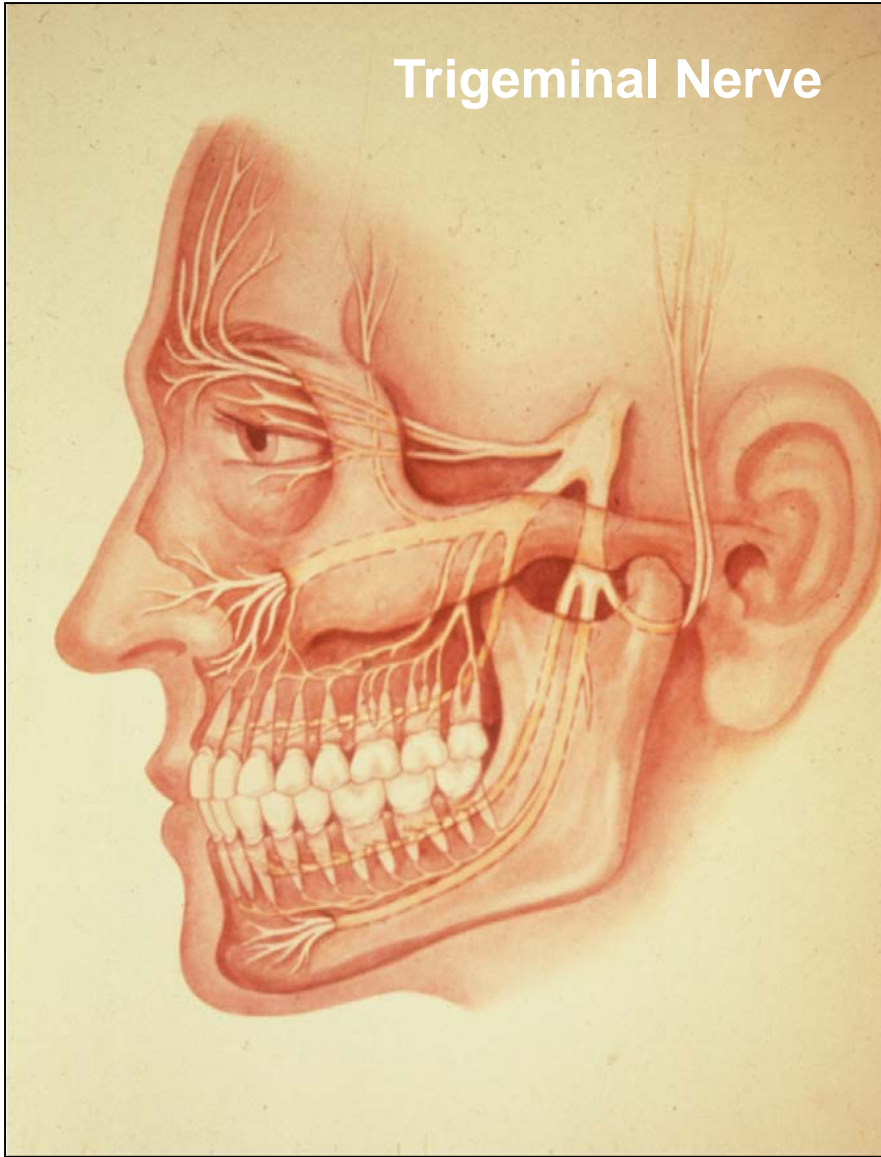


Problem: the trigeminal nerve is embedded in this diseased marrow.



# The Maxillofacial Region

Trigeminal Nerve

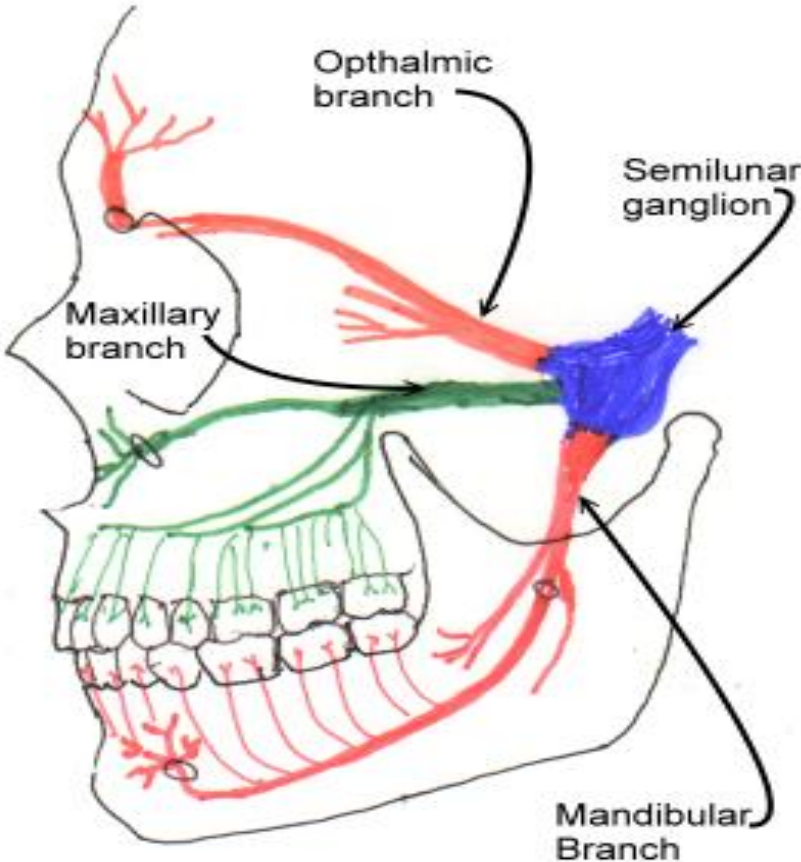


Location of 85%+ of all neuralgias

Brain uses 40% of its sensory input activity interpreting signals from trigeminal nerve

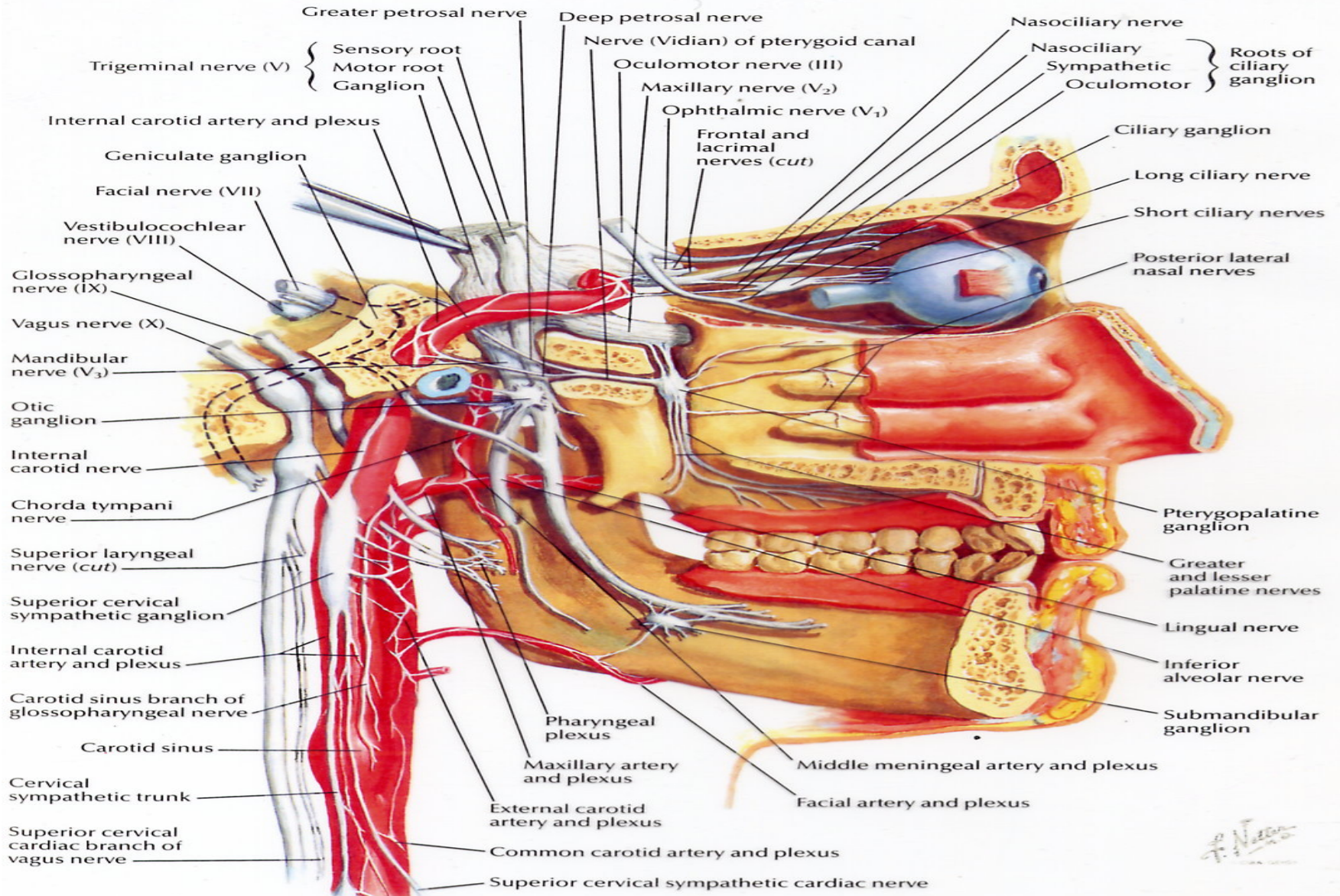
All 3 branches of TN connect at gasserian ganglion

# THE TRIGEMINAL NERVE



# Autonomic Nerves in Head

SEE ALSO PLATES 39, 40, 41, 81, 115, 126, 127, 128, 152





# Retrograde axonal transport of toxins to the brain via the 5<sup>th</sup> cranial nerve, and to the vagus via projections from the sphenopalatine, otic and submandibular ganglia

- **A.D. Speransky**: applied toxic croton oil in the early 1930s to cavities in dog teeth: observed axonal transport of toxin and subsequent destruction of hypothalamus and facial autonomic ganglia

*A basis for the theory of medicine. International Publishers, New York and Moskau, 1935*

- **P. Stoertebecker**: neurologist at the Karolinska Institute in Sweden repeated in the early 70s Speransky's earlier experiments and published on axonal transport of mercury from the oral cavity to the facial ANS ganglia and trigeminal ganglion.

*Mercury Poisoning from Dental Amalgam. BioProbe, Orlando, Florida, 1985*

# Parasympathetic fibers from the Sphenopalatine and Otic Ganglion innervate the Dental Pulp and have projections to the Vagus Nerve

- *Otic ganglion parasympathetic neurons innervate the pulp of the mandibular incisor or the guinea pig: Segade L, Suarez-Quintanilla D [Neuroscience Letters 1988, 90\(1-2\) 33-38](#)*
- *Local actions of acetylcholine on vasomotor regulation in rat incisor pulp Olgart L et al; [Acta physiologica scandinavica 1996, 158\(4\) 311-316](#)*
- *The excitatory action of acetylcholine on intradental sensory units*
- *Maegerstam et al, [Acta physiologica scand. 1975, 93\(1\) 113-118](#)*
- *Occurrence of axons with certain immunohistochemical markers in teleost of gingival and teeth, Tuisku F, Hildebrand C, [Brain Research, 1996, 729\(1\), 137-141](#)*
- *Cat dental pulp after denervation and subsequent re-innervation: changes in blood flow regulation and distribution of neuropeptide Y, GAP-43 and neurotrophin receptor-like immunoreactivity, Olgart L, Edwall L, Fired K; [Brain Research 1993, 625\(1\) 109-119](#)*



## The Sphenopalatine ganglion: it connects the often toxic trigeminal fibers and sympathetics from the teeth with the vagus

- **Parasympathetic: Connection from the vagus nerve and the 3 vagal ganglia** in the brain stem. Parasympathetic nerves traveling piggyback on the N.petrosus major and fibers of the facial nerve originating at the ganglia geniculi (establishing a connection to the 7th cranial nerve)
- **Sympathetic** connection via the N.petrosus profundus (establishing a connection with the superior cervical ganglion and the SNS)
- **Sensory** nerve supply: via the sphenopalatine nerve and the maxillary nerve (establishing a strong “fine-fiber” connection between trigeminal fibers and parasympathetic fibers inside the ganglion)
  - *Anatomical basis for a parasympathetic and sensory innervation of the intracranial segment of the internal carotid artery in man.*  
Suzuki N, Hardebo JE *J Neurolo Sci* 1991 July; 104(1): 19-31
  - *Trigeminal fiber collaterals storing substance P in the sphenopalatine ganglion of the rat. An axon reflex modulating parasympathetic ganglionic activity?*  
Suzuki N et al.; *Neuroscience* 1989;30(3): 595-604

# The Toxic Vagus Syndrome

It is highly probable (and observed by numerous practitioners), that the vagus nerve frequently becomes toxic via its dental contributions and projections. Source of the toxins:

- migrating restoration materials absorbed via the dental pulp. (especially mercury, tin, gold and acrylics)
- biotoxins from jaw bone infections and necrosis (thioethers and mercaptans)
- inhalants (small particles, VOCs) migrating from the sinusses

Any tissue innervated by the vagus can be affected. Closest to the toxic origin are the thyroid and the heart

The toxic vagus affects all aspects of heart health: the rhythm, the metabolic activity of the heart muscle and the activity of immune competent cells in the vascular endothelium

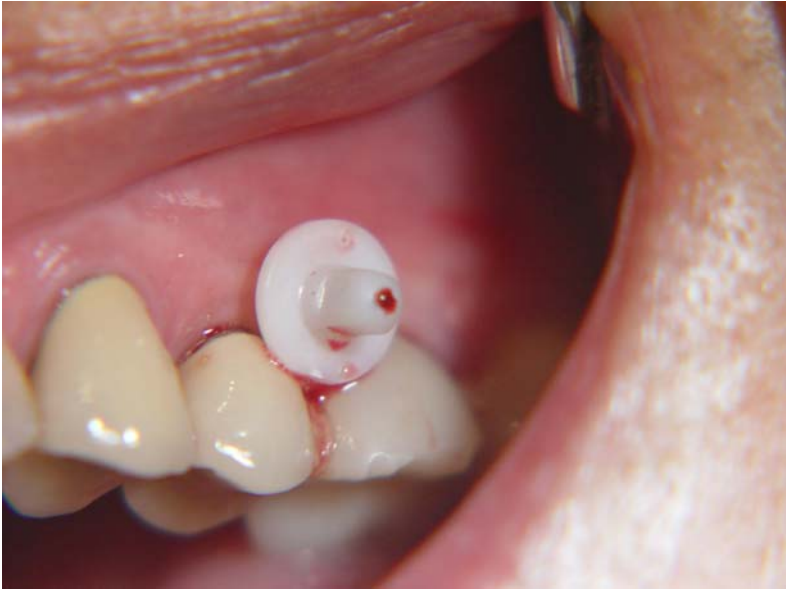
The vagus can also become toxic on the other end - via pelvic and intestinal infections or infestations

# Treatment options, when the vagus has become toxic and is affecting the heart

- **Work a life long metal- and dental plastic detoxification protocol (DMSA, DMPS, EDTA, sauna, glycine, homeopathic antidotes, laser detox)**
- **Decrease overall toxic and allergic load of the vagal system: avoid allergenic foods and environmental triggers, eat organic and non-GMO, desensitize**
- **Decrease emotional body burden (mediated via the smart vagus - Stephen Porges PhD): trauma therapy, depth psychology**
- **Specific interventions:**
  - **remove impacted wisdom teeth**
  - **clear up jaw bone cavitations (surgical curettage or intraosseous ozone injections – Phil Mollica DDS method)**
  - **neuraltherapy to the heart (segmental injections, vagal ganglia injections, superior cervical and stellate ganglion injections, sphenopalatine ganglion injections, i.v. procaine)**
  - **Diagnose and treat kryptopyrroluria (healthy jaw bone has highest concentration of zinc, which is missing in KPU)**
  - **Diagnose and treat Vit D deficiency**
  - **Use long term natural antimicrobials (freeze dried garlic, rizols or ozonated plant oils)**



FEB 24 2004





Effect of lead on cardiac parasympathetic function

TERUYA K; SAKURAI H; OMAE K; HIGASHI T; MUTO T; KANEKO Y

*International Archives of Occupational and Environmental Health, 1991, 62 (8) 549-553*

- **lead causes abnormal parameters of cardiac parasympathetic function**

Autonomic nervous system dysfunction in workers exposed to lead, zinc, and copper in relation to peripheral nerve conduction : a study of R-R interval variability

MURATA K; ARAKI S :


*American Journal of Industrial Medicine, 1991, 20 (5) 663-671*

- **Lead and toxic doses of zinc and copper cause abnormal HRV recordings**

# **Cardiac autonomic activity in methyl mercury neurotoxicity: 14-year follow-up of a Faroese birth cohort**

GRANDJEAN Philippe; MURATA Katsuyuki; BUDIZ-JOERGENSEN Esben; WEIHE Pal

*The Journal of Pediatrics*, 2004, 144 (2) 169-176

- *Objective: To determine whether heart function in childhood is affected by exposure to methyl mercury (MeHg) from seafood.*
  - *Examination: at ages 7 and 14 years included blood pressure, heart rate variability (HRV) and its frequency components of autonomic origin, and brainstem auditory evoked potentials (BAEPs). Mercury concentrations were determined in cord blood and in the child's hair.*
  - ***Conclusion: Methyl mercury exposure of ANS neurons was associated with decreased sympathetic (LF) and parasympathetic (HF) modulation of the ANS***
- 

LEAD-STIMULATION EFFECTS ON HUMAN CARDIAC ORIENTING AND BLINK REFLEXES (EFFET DE LA STIMULATION SUR LES REFLEXES PALPEBRAUX ET LE RYTHME CARDIAQUE CHEZ L'HOMME)

GRAHAM F K; PUTNAM L E; LEAVITT L A

*J. EXPER. PSYCHOL., HUM. PERCEPT. PERFORM.*, 1975, 104 (2) 161-169

➤ **lead travels in the ANS and causes pathological changes**

Cardiovascular reflexes and low long-term exposure to mercury vapor  
Piikivi, L

*International Archives of Occupational and Environmental Health*,  
1989, 61 (6) 391-395

➤ **Hg travels in the ANS and many ANS parameters become abnormal after long term Hg exposure**

# *Low level exposures to organophosphorus esters may cause neurotoxicity*

JAMAL Goran A; HANSEN Stig; JULU Meter; O WRIGHT Paul

*Toxicology : (Amsterdam), 2002, 181-18 23-33*

*A large number of published studies support the notion that long term, low level (LTLL) exposure to organophosphorus (OP) esters may cause autonomic, neurological and neurobehavioral effects.*

*The question addressed in this particular review is whether LTLL exposure to OP may produce neurotoxicity.*

- 11 studies support the existence of a positive link between exposure to OP and neurotoxicity; Appearance of neurotoxicity does not seem to be related to the number or the intensity of acute cholinergic attacks
- Additional five studies using experimental animals, all of which showed a positive link between OP and neurotoxicity  
  
seven additional case studies without controls, some involving large numbers of patients, concluded that there is a positive link between OP and neurotoxicity.
- 19 additional studies investigated such a link using cases and control groups. Of these, 15 studies (about 80%) showed a positive link and only four failed to identify any link between OP and neurotoxicity.
- ***There is a characteristic pattern of involvement of 15 functional indices of the autonomic nervous system***
- The peripheral nerve involvement in OP exposure is predominantly sensory in nature affecting both small and large fiber populations. Neurobehavioral involvement of mainly cognitive dysfunction and other features are also described in other studies

# Review

[www.KlinghardtNeurobiology.com](http://www.KlinghardtNeurobiology.com)

Cavitations are a frequent cause of referred, seemingly distant problems:

- Joint degeneration (esp. large joints: hip, knee and shoulder)
- Organ and systems deterioration with a large variety of pathological findings:
  - ❑ Heart: **cardiomyopathy, coronary heart disease, arrhythmias**
  - ❑ Brain: CFIDS, FMS, MCS, AD, diffuse vessel disease, areas of hypoperfusion and/or hypometabolism, psychiatric and emotional disorders
  - ❑ Chronic liver disease (symptomatic Hep.C, fatty degeneration, impaired detoxification, stasis of the bile system)
  - ❑ All flavors of kidney disease
  - ❑ Immune system breakdown with chronic infections (HHV-6, Lyme disease, mycoplasma), fatigue, cancer
  - ❑ Intestinal problems: leaky gut, recurrent parasitosis, Crohn's disease, ulcerative colitis