Diagnosis, Case Selection and Treatment Planning in Endodontics

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Introduction

- For most patients requiring endodontic therapy, diagnosis and treatment planning for the affected tooth or teeth is quite straightforward
- As long as good bacterial control and a satisfactory technical standard is achieved, the outcome is predictably successful
- For many patients, decisions regarding endodontic treatment may be much more complex
- The issues involved in arriving at a decision may range from the appropriateness of endodontic treatment to the level of difficulty of treatment or a compromised prognosis for the tooth based on other factors

Messer HH. Clinical judgement and decision making in endodontics. Aust Endod J. 1999 Dec;25(3):124-32.

Introduction

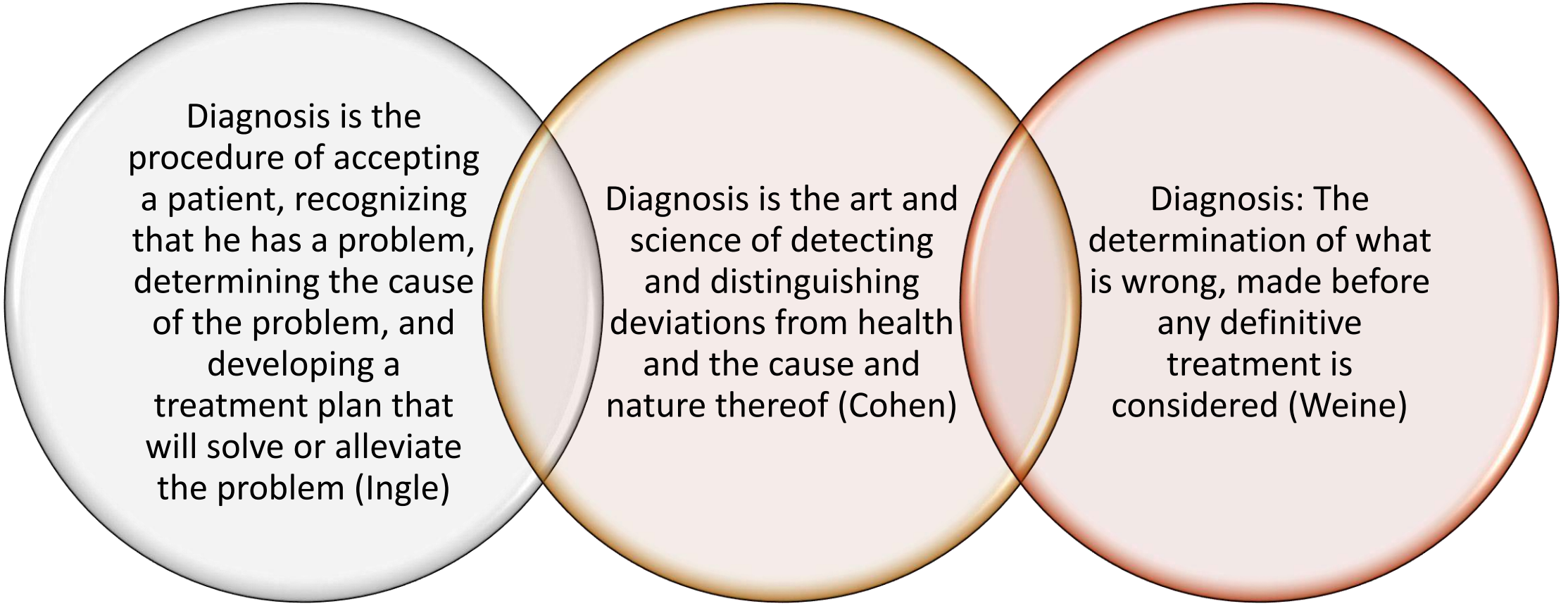
Meticulous diagnostic technique is essential in identifying the pathological status of the pulp

And treatment planning is paramount in establishing the most effective sequence of procedures to restore the patient's tooth and mouth to a healthy and functional state

Stewart T. Diagnosis and treatment planning are essential prior to commencing endodontic treatment: discuss this statement as it relates to clinical endodontic management. Aust Endod J. 2005 Apr;31(1):29-34.

Diagnosis

Diagnosis



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Cohen's Pathways of the Pulp – 11th Edition
Franklin S. Weine – Endodontic Therapy 6th Edition

Diagnosis

- Orofacial pain - primary reason for presentation to a dentist
- Misdiagnosis - lead to the patient receiving inappropriate treatment, the persistence of symptoms and treatment failure

1. Comprehensive history taking
2. Evaluation of the presenting signs and symptoms
3. Special investigations/tests
4. Careful observation of the response to treatment form the foundations of good diagnostic technique

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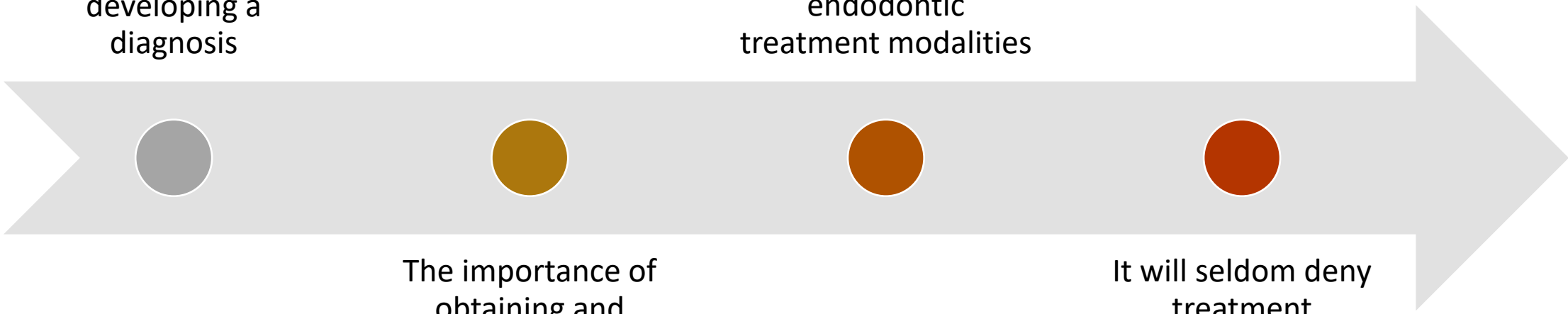
History

Anamnesis, “recollection” or “calling to memory,” is the first step in developing a diagnosis

The importance of obtaining and recording this “history” goes beyond medicolegal protection

A complete history will not only determine treatment but also influence modifications in endodontic treatment modalities

It will seldom deny treatment



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Case History

- **Definition:** A case history is defined as a planned professional conversation that enables the patient to communicate his/her symptoms, feelings and fears to the clinician so as to obtain an insight into the nature of patient's illness and his/her attitude towards them

Information Obtained Before Recording Chief Complaint

- Patient's Name
- Registration number
- Age
- Sex
- Address
- Occupation
- Marital status

NAME

- To communicate with the patient
- To establish a rapport with the patient
- Record maintainance
- Psychological benefits

REGISTRATION NUMBER

- Maintaining record
- Billing purposes
- Medicolegal aspects

AGE

- For diagnosis
- Treatment planning
- Used to calculate the dose of the drug

➢ **Diseases More Commonly Present At Birth**

- Micrognathia
- Cleft lip and cleft palate
- Ankyloglossia
- Predeciduous dentition
- Teratoma
- Hemophilia

➢ **Diseases Present in Children and Young Adults**

- Dental caries
- Juvenile periodontitis
- Benign migratory glossitis
- Pemphigus
- Recurrent aphthous stomatitis
- Dentigerous cyst
- Infectious mononucleosis
- Diptheria
- Rickets

➢ Diseases Present in Adults and Older Patients

1. Attrition
2. Abrasion
3. Gingival Recession
4. Periodontitis
5. Lichen planus
6. Ameloblastoma
7. Trigeminal neuralgia
8. Fibroma
9. Verrucous carcinoma
10. Iron deficiency anemia
11. Diabetes
12. Hypertension
13. Asthma

➢ Drug Doses for Children

1. Young Rule

$$\frac{\text{Child's Age}}{\text{Age + 12}} \times \text{Adult Dose}$$

2. Clark Rule

$$\frac{\text{Child's Age at Next Birthday}}{24} \times \text{Adult Dose}$$

3. Dilling Rule

$$\frac{\text{Age}}{20} \times \text{Adult Dose}$$

SEX

- Certain Diseases are gender specific
- **Diseases common in males**
  - Attrition
  - Leukoplakia
  - Squamous cell carcinoma
  - Melanoma
  - Lymphoma
- **Diseases common in females**
- Iron Defeciency Anaemia
- Sjogren's Syndrome
- Osteoporosis
- Apthous ulcers

OCCUPATION

- To assess the socioeconomic
- Predilection of diseases in different occupations
- Eg. Hepatitis B is common in Dentists and Surgeon

MARITAL STATUS

- To see any history of consanguineous marriages
- The high consanguinity rates coupled by large family size in some communities could induce the expression of autosomal recessive diseases

Chief Complaint

Chief complaint – in the patient's own words – description of the dental problem for which the patient seeks care

Verbal complaint – accompanied by – pointing to the general area of the problem

After recording of chief complaint – examination process is continued by obtaining a history of the present illness

A patient in acute distress should undergo diagnosis and examination as quickly as possible so the chief complaint may be treated as expeditiously as possible

Treatment should be not be rendered unless the examiner is certain of the diagnosis

Patients with severe pain from pulpitis have difficulty in cooperating with the diagnostic procedures, but until the diagnosis has been made and the correct tooth identified, treatment must not be started

History of Present Illness

Should indicate the severity and the urgency of the problem

If the problem is long-standing – detailed questions about past episodes of pain or swelling and any previous treatment performed to remedy the condition

If the chief complaint is “toothache” but the symptoms are too vague to establish a diagnosis, analgesics can be prescribed to help the patient tolerate the pain until the toothache localizes.

If the patient arrives self-medicated with analgesics or sedatives, a diagnosis may be difficult to establish.

The initial questions should help establish components of pain: **Intensity, Provocation-Attenuation and Duration**

Intensity. "How intense is the pain?"

It often helps to quantify how much pain the patient is actually having.

The clinician might ask, **On a scale from 1 to 10, with 10 the most severe, how would the patient rate their symptoms?**

Subjectively measured by what is necessary for the diminution of pain—for example, acetaminophen versus a narcotic pain reliever.

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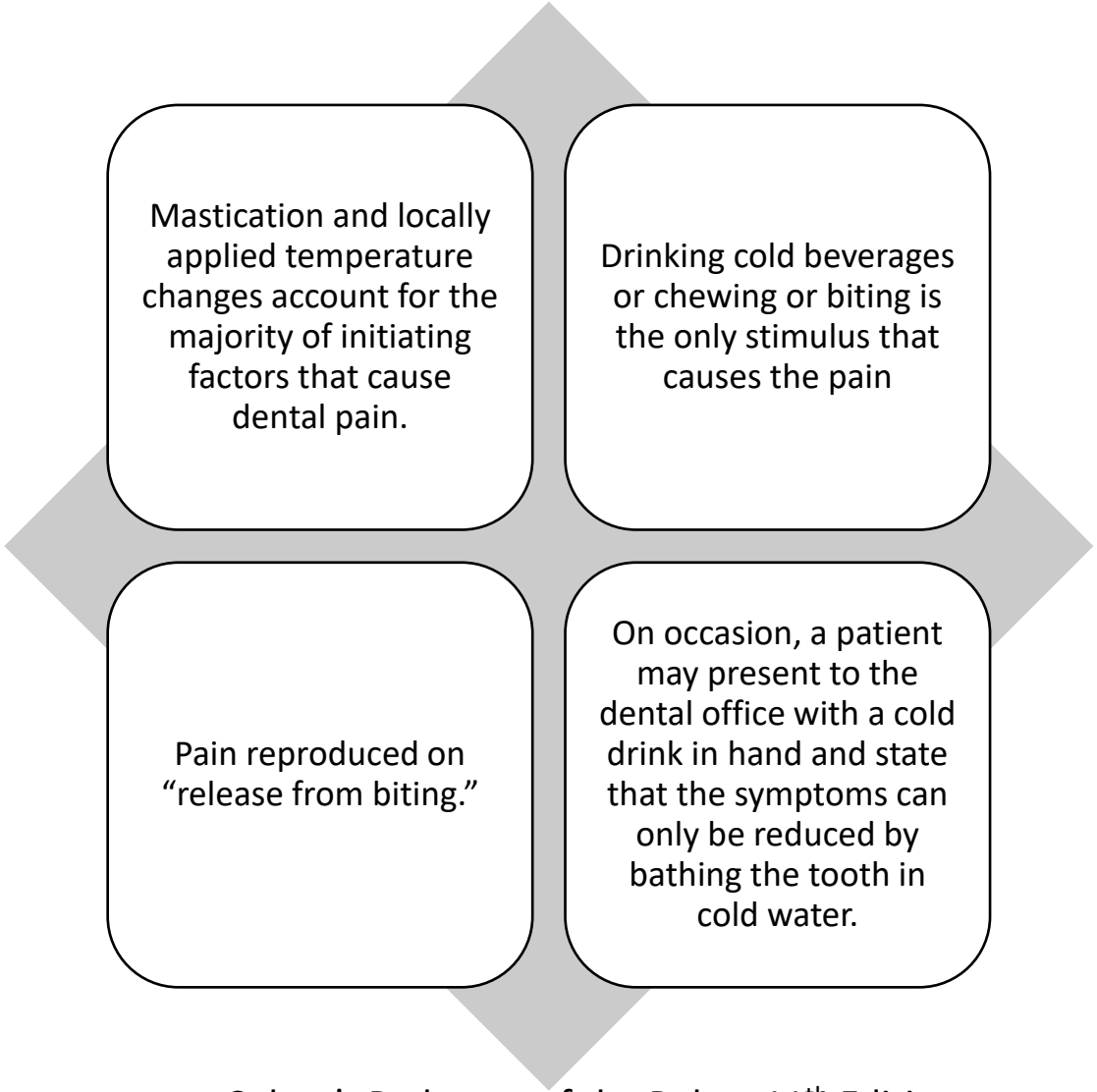
Provocation and Attenuation. "What produces or reduces the symptoms?"



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Duration. “Do the symptoms subside shortly, or do they linger after they are provoked?”

The difference between a cold sensitivity that subsides in a few seconds and one that subsides in minutes may determine whether a clinician repairs a defective restoration or provides endodontic treatment.

Evaluation: Clinicians first test control teeth (contralateral “normal” tooth) to define a “normal” response for the patient; thus, “lingering” pain is apparent when comparing the duration between the control teeth and the suspected tooth.

Past Dental History

The type and number of past dental treatments should reveal the degree of sophistication of previous therapy and help in evaluating the expectations of the patient as well.

The presence of obvious dental neglect or the unwillingness of the patient to have a pulpless tooth restored may rule out endodontic therapy

Medical History

A complete medical history should contain, as a baseline, the vital signs; give early warning of unsuspected general disease; and define risks to the health of the staff as well as identify the risks of treatment to the patient

The medical history must be updated regularly, especially if there have been any changes in the patient's health status

- Patients should be asked if they have had or presently have any of the following diseases

1. Rheumatic Fever
2. Artificial Heart Valves
3. Coronary Artery Disease
4. Hypertension
5. Diabetes
6. Hepatitis
7. Blood Diseases
8. Prostheses for Total Replacement of Joints
9. Other Serious Diseases
10. HIV, Syphilis, and Other Sexually Transmitted Diseases
11. Drug and Medication Therapy

Rheumatic Fever

Patient with a history of rheumatic fever has the potential of suffering an attack of subacute bacterial endocarditis (SBE) after any bacteremia

Dental procedure, whether a simple prophylaxis, the extraction of a tooth, or certain phases of endodontic treatment, causes some degree of bacteremia, definite measures must be taken to avoid the possibility of SBE

- Bender et al. paper in 1963 on the degree of bacteremia after various dental procedures firmly established that many portions of endodontic treatment will induce no bacteremia
- Reported – pulp extirpation and filing beyond the apex produced bacteremia – dissipated after 10 minutes.
- When enlarging procedures were carried out within the confines of the canal, no bacteremia was produced in most cases.
- Even the placement of a rubber dam causes gingival impingement, and a bacteremia may result.
- Therefore it is best to use the standard prophylactic procedures before any endodontic appointment.

On the basis of this report, it is strongly suggested that antibiotic premedication be given to any patient with a history of rheumatic heart disease—at the initial appointment for endodontic treatment

And at any subsequent appointment if the possibility of going past the apex exists, whenever a periapical lesion is present, and at any surgical appointment.

AHA Guidelines (2002)

Conditions requiring the use of antibiotic coverage are as follows	Antibiotic coverage is not necessary for the following
1. Prosthetic heart valves, 2. Previous history of bacterial endocarditis 3. Most congenital heart malformations 4. Heart valves damaged or scarred by a history of rheumatic heart disease 5. Congenital heart or heart valve defects and any other valvular dysfunction, even after intervening cardiac surgery 6. Hypertrophic cardiomyopathy 7. Mitral valve prolapse with valvular regurgitation 8. Mitral valve prolapse without valvular regurgitation but with thickening and/or redundancy of the valve leaflets in men ages 45 years and older	1. Isolated atrial defects 2. 6 months after repair of atrial septal defect 3. Ventricular septal defect, or patent ductus arteriosus 4. Previous coronary bypass graft surgery 5. Mitral prolapse without regurgitation 6. Physiologic, functional, or innocent heart murmurs 7. Previous Kawasaki disease or previous rheumatic fever without valvular dysfunction 8. Cardiac pacemakers and implanted defibrillators

Dental procedures requiring antibiotic prophylaxis	Procedures for which antibiotic coverage is not recommended
Treatment known to induce gingival or mucosal bleeding 1. Professional cleaning in which any subgingival manipulation is involved 2. Extractions	Treatment not likely to induce gingival bleeding, such as 1. Adjustment of orthodontic appliances 2. Restorations completely supragingival, not requiring the use of a matrix retainer

Antibiotic Prophylaxis Regimen (2007)

Antibiotic Prophylaxis Regimen	Drugs
1. Standard regimen	Adults: 2.0 g Amoxicillin orally 1 hour before the dental procedure Children: 50 mg/kg Amoxicillin orally 1 hour before the dental procedure
2. For patients with allergy to amoxicillin, ampicillin, or penicillin	Adults: 600 mg Clindamycin or 2.0 g Cephalexin or Cefadroxil is taken orally 1 hour before the procedure Children: 20 mg/kg Clindamycin orally 1 hour before the procedure
3. For patients with intermediate hypersensitivity to penicillins	Adults: 500 mg Azithromycin or 500 mg Clarithromycin orally 1 hour before the procedure Children: 15 mg/kg Azithromycin/Clarithromycin orally 1 hour before the procedure
4. For those patients who are unable to take oral prophylaxis who are allergic to amoxicillin, ampicillin, or penicillin	Adults: 600 mg Clindamycin IV or 1.0 g Cefazolin/Ceftriaxone IM or IV within 30 minutes before the procedure Children: 20 mg/kg Clindamycin IV or 50 mg/kg Cefazolin/Ceftriaxone IM or IV

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Rheumatic Fever

- In addition to merely asking a patient about the history of rheumatic fever, further questioning should be pursued with a patient who mentions having had any of the symptoms.
- These symptoms, usually appearing in childhood or early adolescence, include

1. Red, tender, and painful joints
2. Small fibrous nodules on the extensor surfaces of the wrists or ankles
3. Recurrent tonsillitis or other streptococcal diseases
4. Chorea, acute carditis, or
5. Rheumatic arthritis

- If any question exists as to the possibility of this disease, it is much safer to prescribe the suggested antibiotic medication than to chance SBE. Consultation with the patient's physician is recommended in any cases of doubt

Artificial Heart Valves

- Insertion of an artificial valve to replace a valve damaged by congenital defect or by systemic or local disease is a common surgical procedure
- Artificial valves currently used are composed chiefly of Teflon or Teflon-like materials to diminish the possibility of adhesions
- The danger of clumps of bacterial colonies collecting on these valves increases greatly after a bacteremia
- Therefore any patient with artificial heart valves should receive the same prophylactic antibiotic administration as a patient with a history of rheumatic fever

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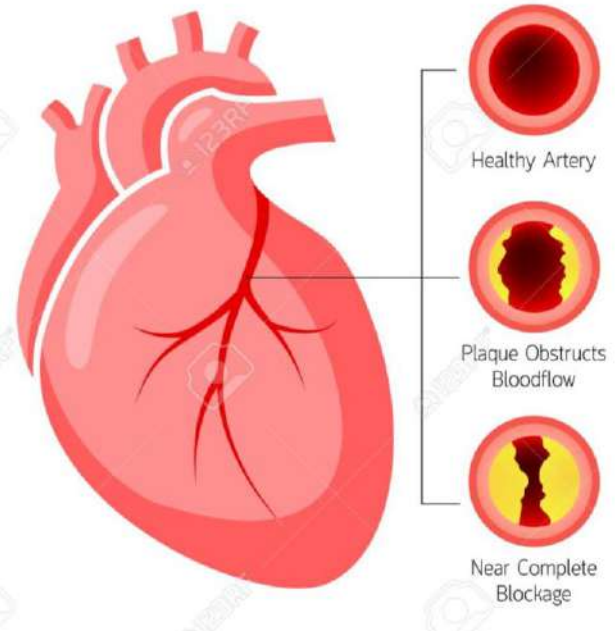
Coronary Artery Disease

- Coronary occlusion and other cardiovascular diseases are most common after middle age
- Includes:

1. Hypertension
2. Angina pectoris
3. Arteriosclerosis
4. Stressful occupations
5. Smoking



- Does not contraindicate endodontic therapy – certain precautions should be observed when treating patients
- Patient with a previous episode of coronary occlusion is receiving anticoagulant therapy.
- Nonsurgical endodontic treatment, including vital pulp extirpation, requires no alteration in the administration of anticoagulants
- If surgery becomes mandatory, the patient's physician should be consulted
- Nonsurgical treatment is much preferred if a choice exists

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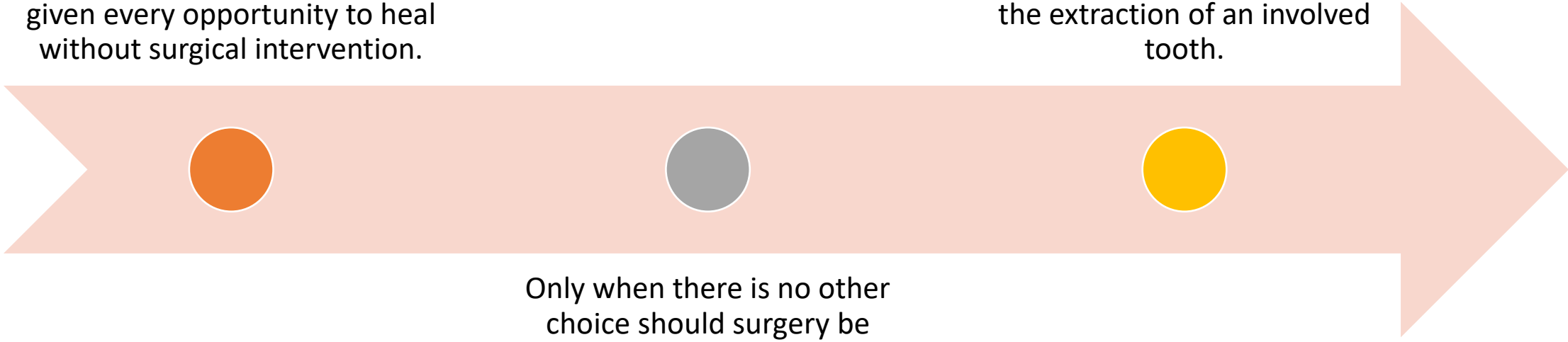
Presence of a large radiolucency, failure to reach the apex, persistent postoperative tenderness, and other possible indications for endodontic surgery should be given every opportunity to heal without surgical intervention.



However, because endodontic surgery usually ends with the areas of incision apposed and sutured, it is still preferable to the extraction of an involved tooth.

Only when there is no other choice should surgery be considered.

Hypertension

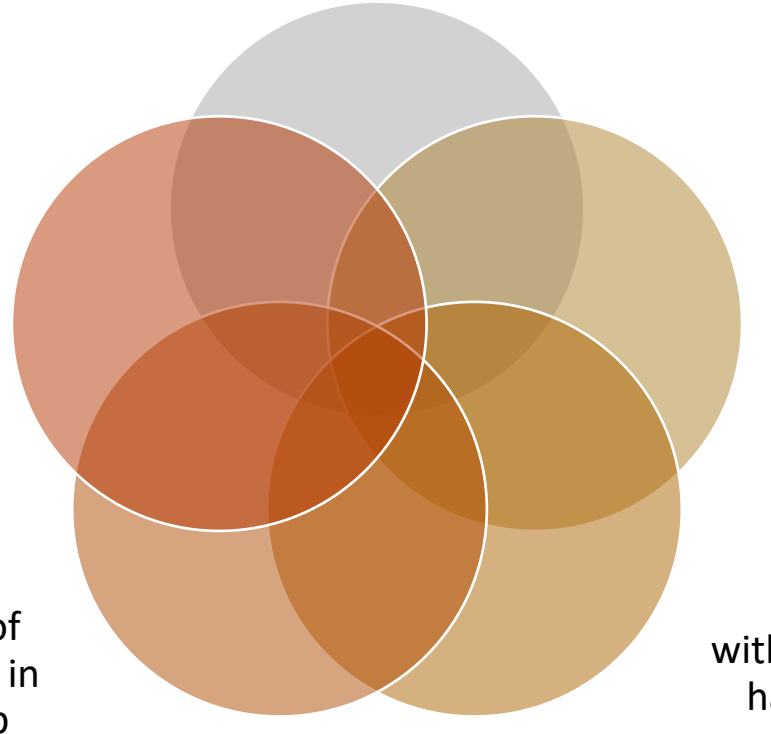
- Symptoms:

1. Shortness of breath
2. Frequent and persistent headaches
3. Poor vision
4. Ringing ears
5. Nosebleeds
6. Dizziness

- Some patients, in earlier phases, have no symptoms
- Treatment is based on reduction of the symptoms by means of various drugs to lower the blood pressure.

For many years, physicians advised dentists to avoid use of epinephrine in local anesthetic administrations for hypertensive patients.

Any pain felt by the patient might produce much more epinephrine within the individual's own system than included in any anesthetic solution



Patients with a history of coronary attack were also included.

Considerable depth of anesthesia is required in endodontics for pulp extirpation and surgery

Local anesthetics without vasoconstrictors have a less profound effect and shorter duration of action

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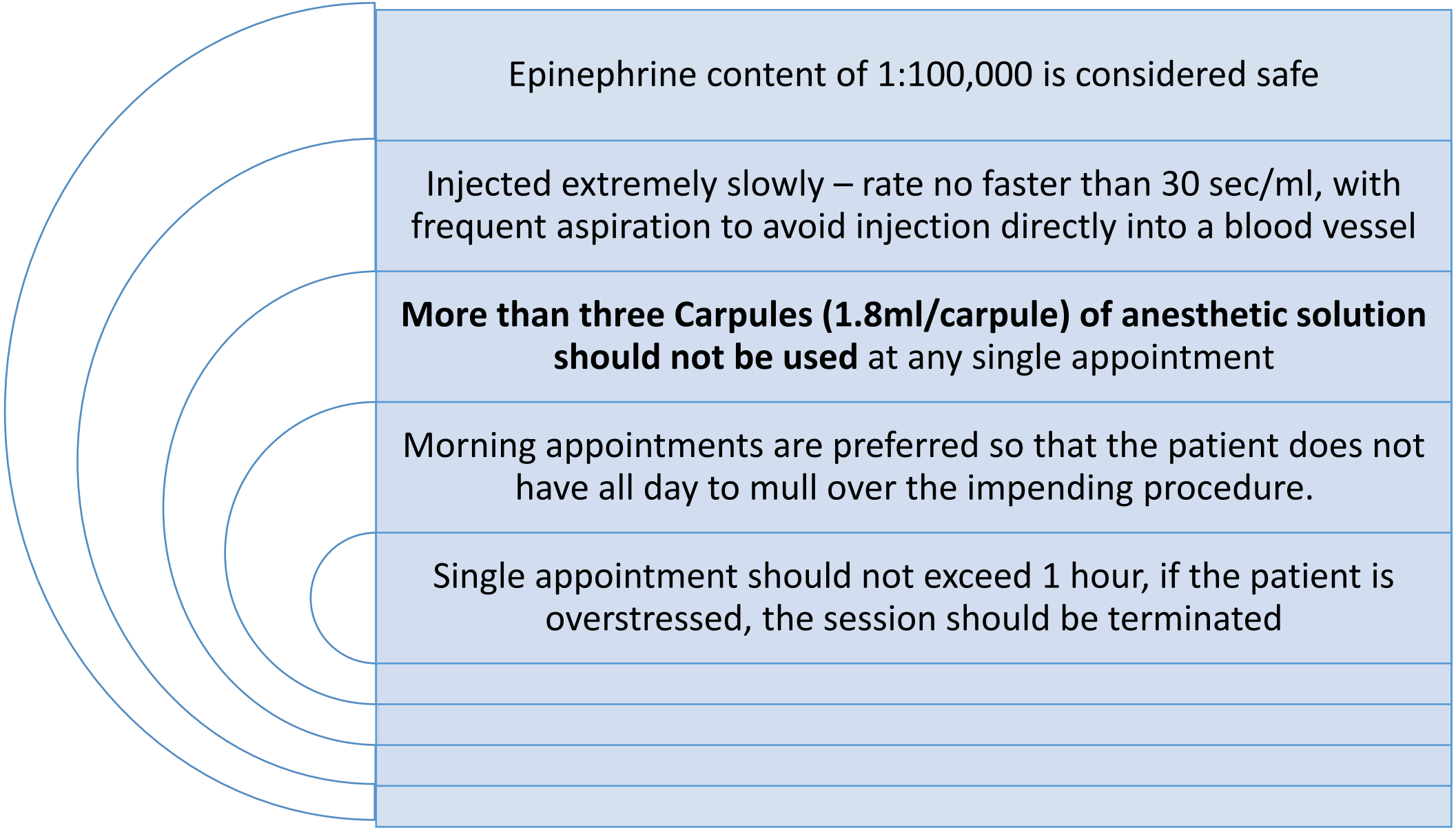

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Diabetes

- Healing – retarded in diabetic patients – should be considered when evaluating periodic postoperative recheck radiographs
- Radiolucencies are slower to fill
- Normal-appearing periapical bone before treatment, 6-month postoperative radiographs may demonstrate a small periapical radiolucency, if the canal was overinstrumented or overfilled
- Reverses within a year – illustrating slower healing potential
- Susceptible to infections and to slow healing, antibiotics should be employed in the presence of infection/Surgical procedure

Choice of anesthetics

Burket, et al., epinephrine should not be used in the local anesthetic solution

Also diabetic patients often suffer from capillary ischemia due to arteriosclerosis

Mepivacaine and lidocaine are available without a vasoconstrictor, and both are effective for routine endodontic procedures of short duration

The scheduling of appointments for diabetic patients

- Important to eat at certain specific intervals.
- Appoitmets scheduled: Early Morning/Afternoon soon after meals

Hepatitis

Microorganisms responsible for hepatitis are highly resistant to the sterilization procedures

Remain in patient's blood for a considerable time after the active phase

Intracanal instruments, which may have picked up causative agents, should be discarded after use

Cause cross-contamination if used on another patient even if subsequently sterilized by dry heat or steam

Blood Diseases

Hazards involved in treating **hemophiliac patient** – internal bleeding caused by local anesthetic injection – particularly for a mandibular block

Necrotic Pulp, no injection needed

Vital pulp – extirpation becomes too painful without an anesthetic

To accomplish pulp removal access is gained to the cavity using a high-speed instrument with a very sharp bur, water spray, and a brush stroke

Pulp exposure gained – cotton pellet dampened with formocresol – placed as a dressing and sealed with zinc oxide-eugenol (ZOE) – patient scheduled to return after a week

Formocresol – fixative effect on pulp

Aids in gaining clot by its caustic action

Second appointment dressing opened – fixed pulp tissue removed by sharp spoon excavators until pain becomes severe

Another formocresol dressing placed

Medicament placed on paper point to reach the vital tissue

Process repeated until all the vital tissue is removed

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Other Bleeding Disorders

- Characterized by gingival hemorrhage

1. Aplastic anemia
2. Cyclic neutropenia
3. Thrombocytopenia
4. Leukemia
5. Purpura
6. Macroglobulinemia

Prostheses for Total Replacement of Joints

According to Mulligan, patients who have had total replacement of joints with prostheses are susceptible to infections

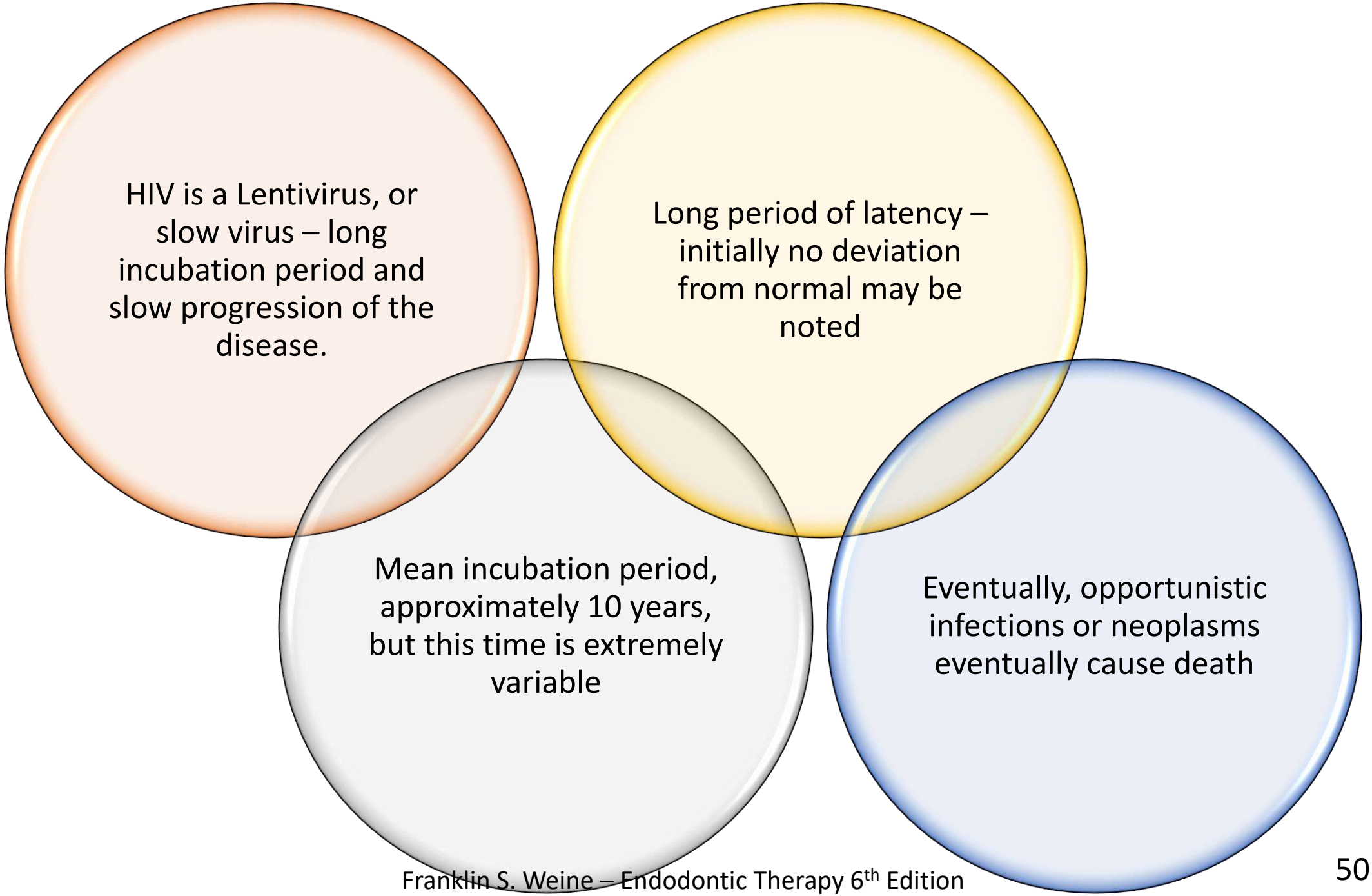
If a bacteremia occurs – infection may lead to failure of the prosthesis

Mulligan suggested that antibiotic coverage is indicated in any dental procedure that might cause bleeding

HIV, Syphilis, and Other Sexually Transmitted Diseases

- With the advent of antibiotics – syphilis cases very significantly decreased
- Oral syphilitic lesions may resemble

1. Chronic draining sinus tract
2. Poorly healed apicoectomy or periodontal surgery scar,
3. Fibroma, or
4. Draining periodontal pocket


HIV is a Lentivirus, or slow virus – long incubation period and slow progression of the disease.
Long period of latency – initially no deviation from normal may be noted
Mean incubation period, approximately 10 years, but this time is extremely variable
Eventually, opportunistic infections or neoplasms eventually cause death

- **Vital aspect of treatment planning** – to determine the current CD4+ lymphocyte count and level of immunosuppression

- **CD4+ lymphocyte count** exceeding 400mm^3 may receive all indicated dental treatment

- **CD4+ lymphocyte count** less than 200mm^3 will have increased susceptibility to opportunistic infections

- Disposable instruments should be used

Drug and Medication Therapy

Medical history must include information concerning the patient's past and present medication therapy

Patient's history of medications must be obtained by using a prepared list or by having the patient fill out a questionnaire

- Have you taken or now taking any of the following medications? Indicate any unusual reactions you have had to any of them.

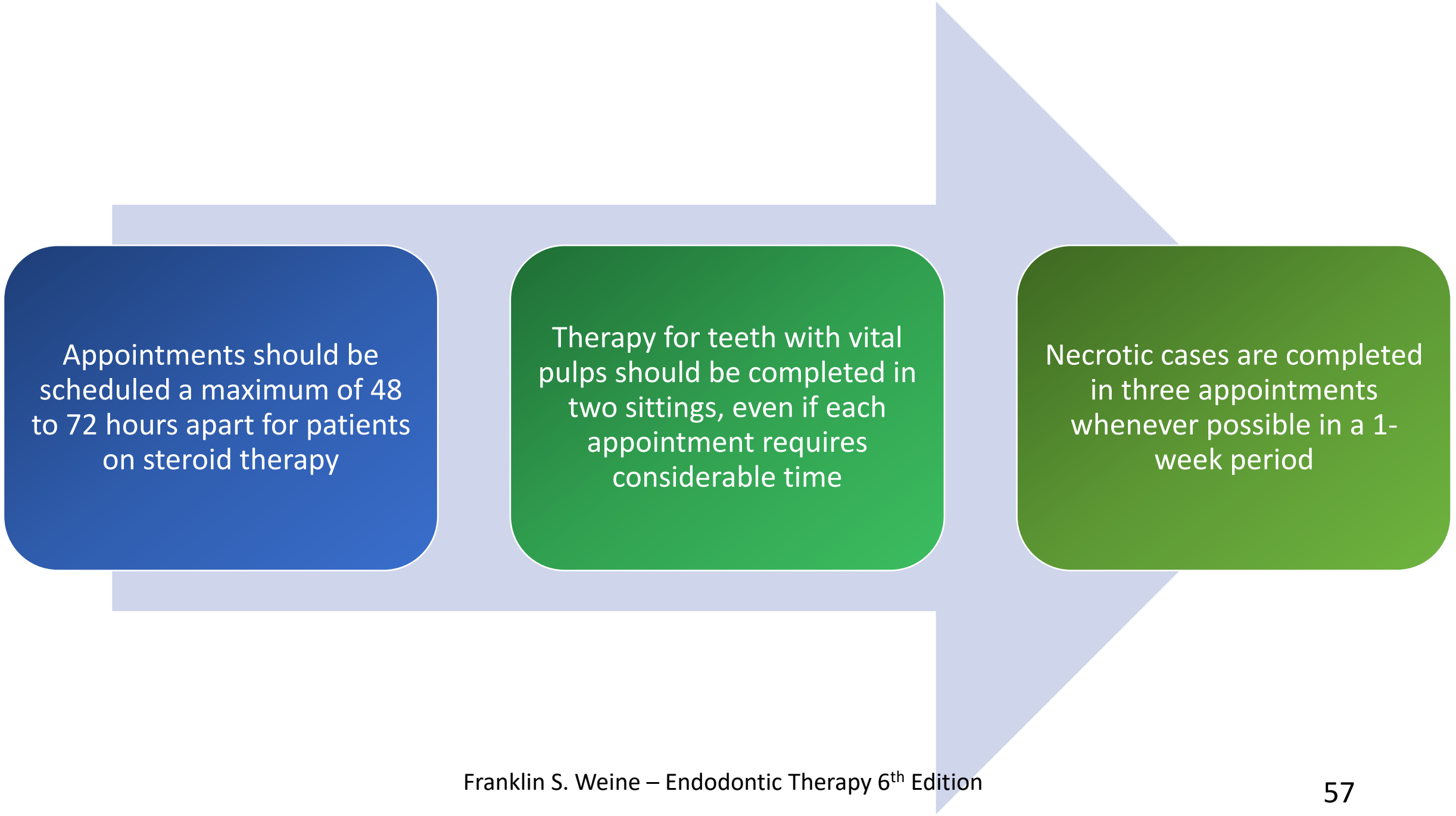
1. Penicillin
2. Sulfonamides
3. Aspirin
4. Other pain relievers, such as, Acitaminophen
5. Antihistamines

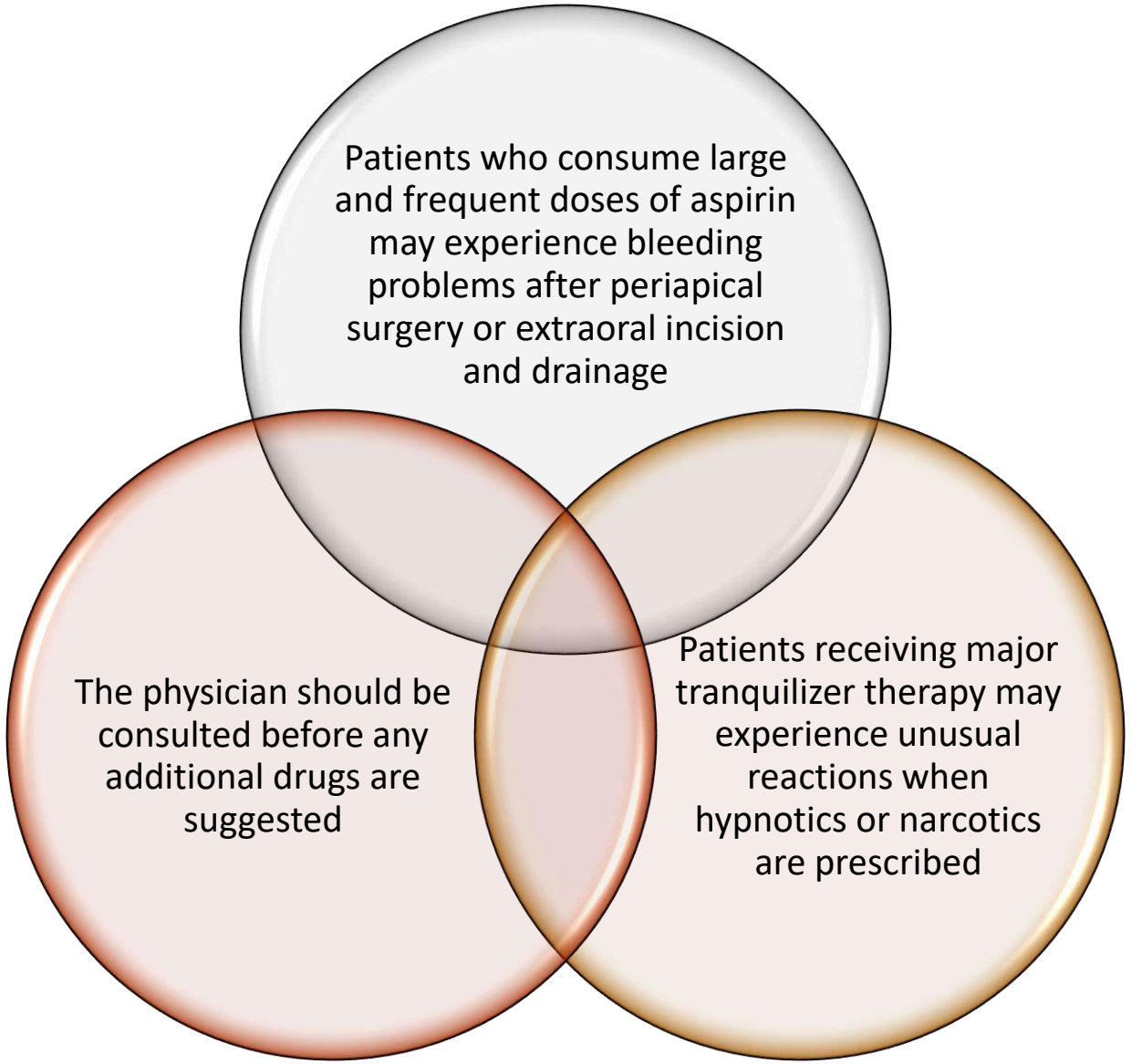
6. Sedatives or sleeping pills
7. Cortisone or other steroids
8. Anticoagulants or blood thinners
9. Digitalis
10. Nitroglycerin, or other drugs for heart trouble
11. Medicines to reduce blood pressure
12. Medicines to reduce excessive fluids (diuretics)
13. Insulin or other medications for diabetes
14. Others

Before prescribing any drugs for a patient, the dentist must be certain that previous administration has not resulted in an allergic reaction

Some patients experience gastric distress after taking aspirin and other NSAIDs

- Patients taking heavy dosage of steroids often experience intratreatment pain and exacerbations due to the suppression of the inflammatory response.
- Steroids are prescribed for patients with
- Pemphigus
- Rheumatoid arthritis
- Scleroderma
- Lupus erythematosus
- Other collagen diseases
- The mildest type of infection may become serious in patients receiving steroid therapy.


Appointments should be scheduled a maximum of 48 to 72 hours apart for patients on steroid therapy
Therapy for teeth with vital pulps should be completed in two sittings, even if each appointment requires considerable time
Necrotic cases are completed in three appointments whenever possible in a 1-week period



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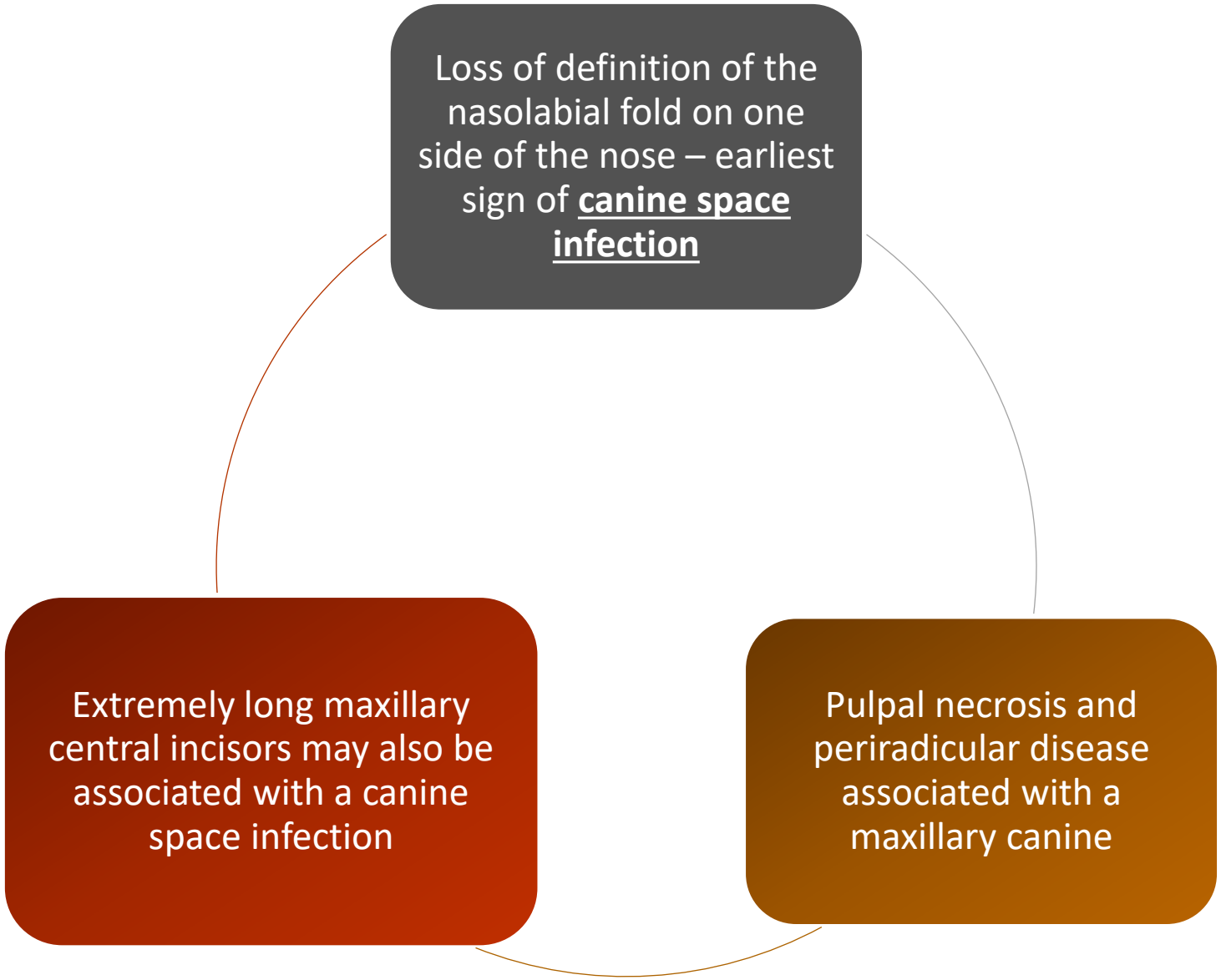
Clinical Examination

- **General Examination**
- Clinician observe patients as they enter the operatory
- Signs of physical limitations should be noted
- Built
- Stature
- Posture
- Gait

- **Extraoral Examination**
- Signs of facial asymmetry resulting from facial swelling – noted
- Visual and palpation examinations of the face and neck to determine whether swelling is present
- Many times – facial swelling can be determined only by palpation when a unilateral “lump or bump” is present

- **Palpation of the cervical and submandibular lymph nodes**
- If nodes - found to be firm and tender along with facial swelling and an elevated temperature – infection is present

- **Extraoral facial swelling** of odontogenic origin typically is the result of endodontic etiology because diffuse facial swelling resulting from a periodontal abscess is rare



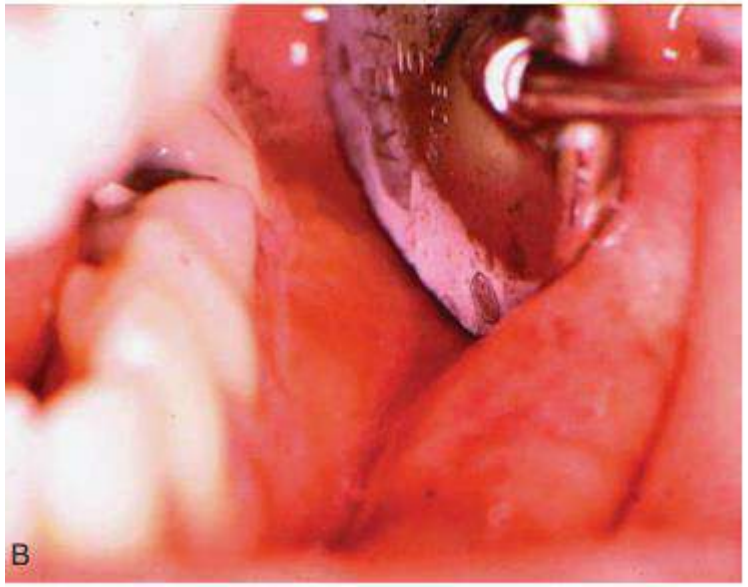
Cohen's Pathways of the Pulp – 11th Edition

A, Canine space swelling of the left side of the face extending into and involving the left eye. B, Swelling of the upper lip and the loss of definition of the nasolabial fold on the patient's left side, which indicates an early canine space infection

- **Buccal space involvement** – the swelling will be extraoral in the area of the posterior cheek

- Associated with infections originating from the buccal root apices of the maxillary premolar and molar teeth and the mandibular premolar and first molar teeth

Buccal space swelling associated with an acute periradicular abscess from the mandibular left second molar



A, Buccal space swelling of the left side of the patient's face. Note the asymmetry of the left side of the face. B, Intraoral view shows swelling present in the left posterior mucobuccal fold. C, This buccal space infection was associated with periradicular disease from the mandibular left second premolar. Note on the radiograph the periradicular radiolucency and large restoration associated with this tooth.

- **Sinus tracts** may also open through the skin of the face
- Close once the offending tooth is treated and healing occurs
- After healing scar is visible on the skin surface in the area of the sinus tract stoma

Parulis on the right anterior side of the face

A, Extraoral sinus tract opening onto the skin in the central chin area. B, Radiograph showing large radiolucency associated with the mandibular incisors. The healed opening of the extraoral sinus tract 1 month after root canal therapy was completed. Note the slight skin concavity in the area of the healed sinus tract.

Intraoral Examination

- Gives the clinician insight as to which intraoral areas may need a more focused evaluation
- Any abnormality should be carefully examined

1. Swelling
2. Localized lymphadenopathy, or
3. Sinus tract

- **Soft Tissue Examination**
- Routine evaluation of the intraoral soft tissues
- The gingiva and mucosa should be dried and examined
- By retracting the tongue and cheek, all of the soft tissue should be examined for abnormalities in color or texture
- Any raised lesions or ulcerations should be documented

- **Intraoral Swelling**
- Visualized and palpated to determine whether they are diffuse or localized and whether they are firm or fluctuant
- These swellings may be present in the

1. Attached gingiva
2. Alveolar mucosa
3. Mucobuccal fold
4. Palate
5. Sublingual tissues

- **Swelling in the anterior part of the palate** associated with an infection present at the apex of the maxillary lateral incisor or the palatal root of the maxillary first premolar

- More than 50% of the maxillary lateral incisor root apices deviate in the distal or palatal directions

- **Swelling in the posterior palate** is most likely associated with the palatal root of maxillary molars

Fluctuant swelling in the posterior palate associated with periradicular disease from the palatal root of the maxillary first molar

- **<u>Intraoral swelling present in the mucobuccal fold</u>** can result from an infection associated with the apex of the root of any maxillary tooth

- Mandibular teeth if the root apices are superior to the level of the muscle attachments and the infection exits the bone on the facial

Fluctuant swelling in the mucobuccal fold associated with periradicular disease from the maxillary central incisor

- Sublingual space swelling: Infection from the root apex spreads to the lingual and exits the alveolar bone superior to the attachment for the mylohyoid muscle
- Tongue elevated, swelling – bilateral because the sublingual space is contiguous with no midline separation
- Submandibular space swelling: Infection exits the alveolar bone to the lingual and is inferior to the attachment of the mylohyoid muscle
- Severe infections can extend into the parapharyngeal space, resulting in intraoral swelling of the tonsillar and pharyngeal areas.
- Life threatening if patient's airway becomes obstructed

Cohen's Pathways of the Pulp – 11th Edition

INTRAORAL SINUS TRACT

Chronic endodontic infection drain through an intraoral communication to the gingival surface – known as a sinus tract

This pathway –extend directly from the source of the infection to a surface opening on the attached gingival surface

Most sinus tracts may not be lined with epithelium throughout their entire length

Epithelial lining does not prevent closure of the tract as long as the source of the problem is properly diagnosed and adequately treated

Sinus tract can also provide a useful aid in determining the source of a given infection

The stoma of the sinus tract may be located directly adjacent to or at a distant site from the infection

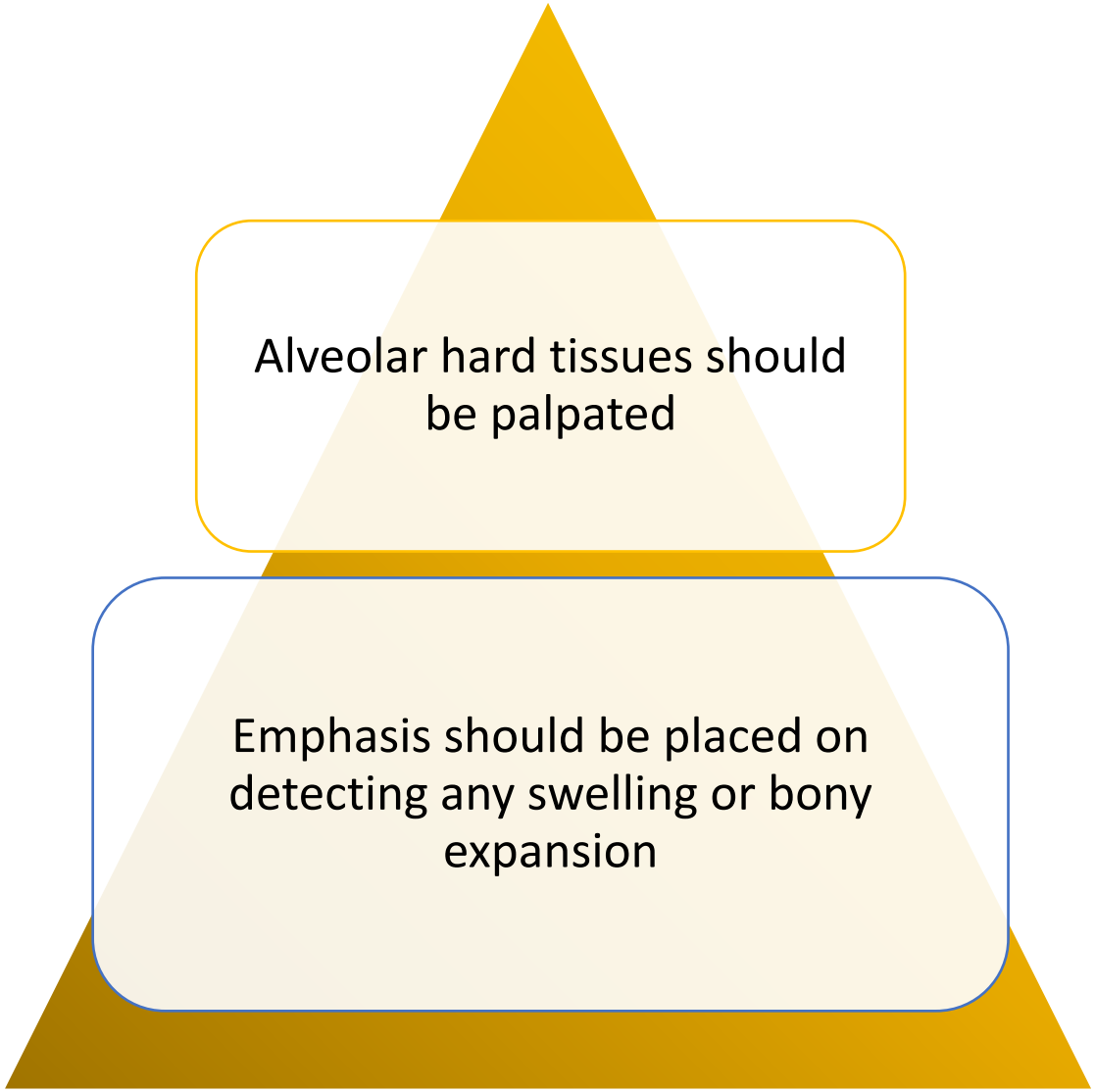
May open in the alveolar mucosa, in the attached gingiva, or through the furcation or gingival crevice.

They may exit through either the facial or the lingual tissues depending on the proximity of the root apices to the cortical bone

Tracing the sinus tract will provide objectivity in diagnosing the location of the problematic tooth

A, To locate the source of an infection, the sinus tract can be traced by threading the stoma with a gutta-percha point.
B, Radiograph of the area shows an old root canal in a maxillary second premolar and a questionable radiolucent area associated with the first premolar, with no clear indication of the etiology of the sinus tract.
C, After tracing the sinus tract, the gutta-percha is seen to be directed to the source of pathosis, the apex of the maxillary first premolar

PALPATION



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Performed by applying firm digital pressure to the mucosa covering the roots and apices

Index finger used to press the mucosa against the underlying cortical bone

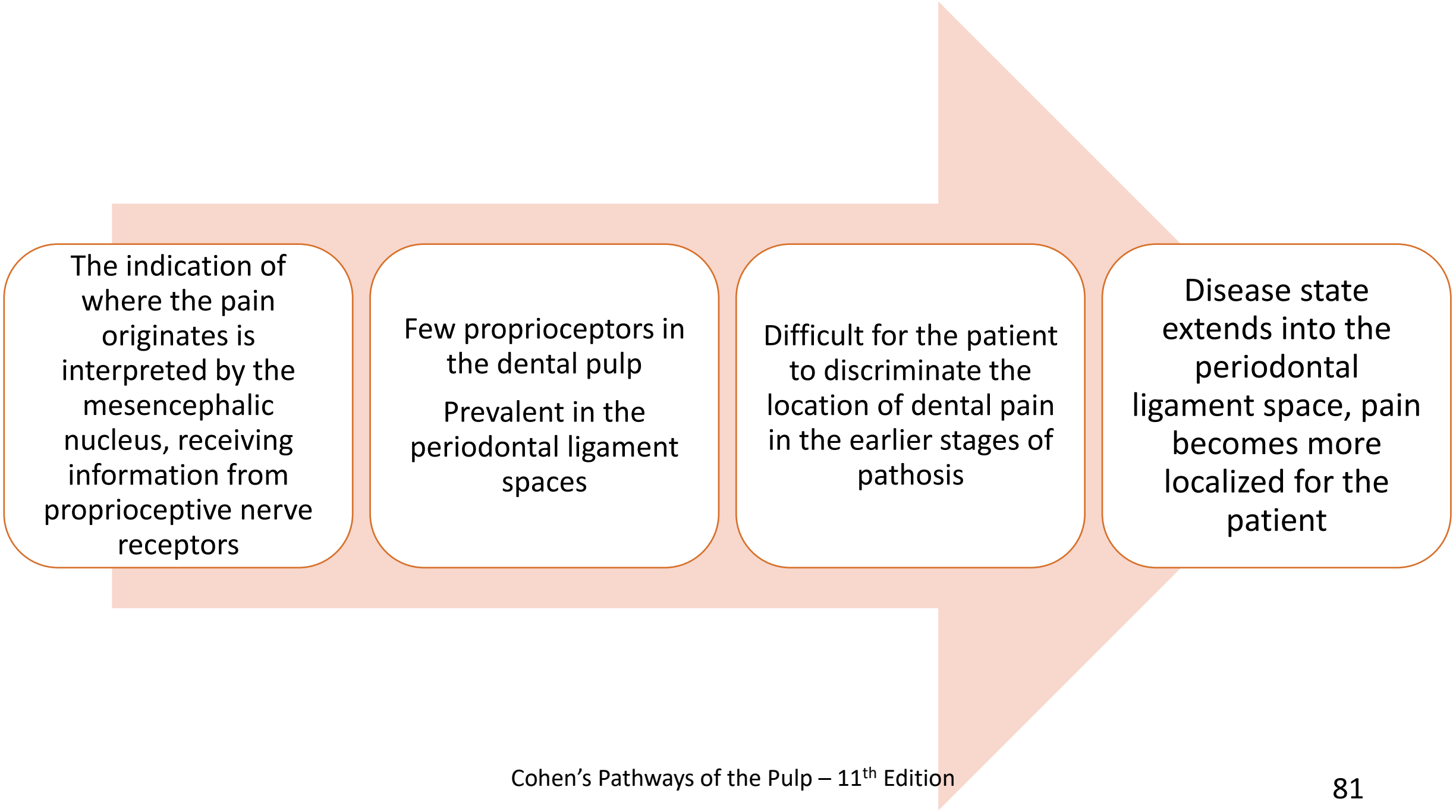
Detects the presence of periradicular abnormalities

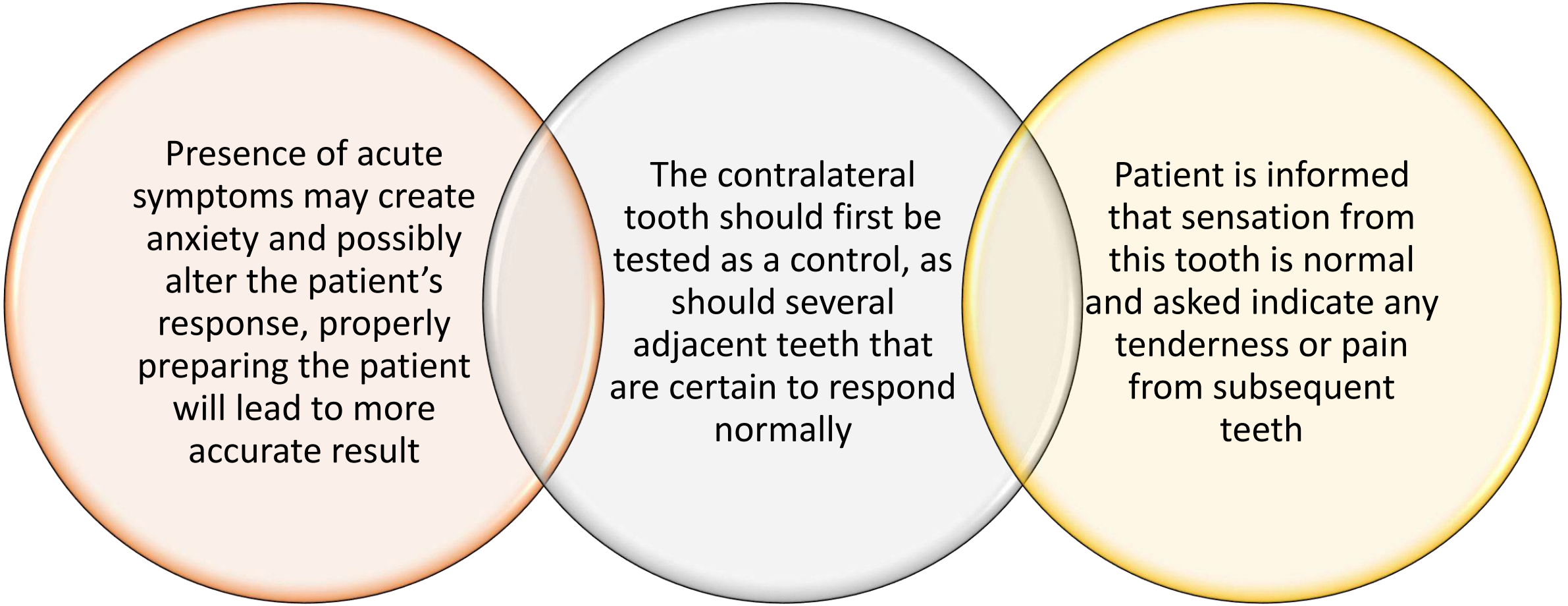
Positive response to palpation indicates an active periradicular inflammatory process

Percussion

- Patient experiencing acute sensitivity or pain on mastication, this response can be duplicated by individually percussing the teeth
- Pain to percussion does not indicate – vitality – indicates inflammation in the periodontal ligament
- This inflammation may be secondary to

1. Trauma
2. Occlusal prematurities
3. Periodontal disease
4. Extension of pulpal disease into the periodontal ligament space

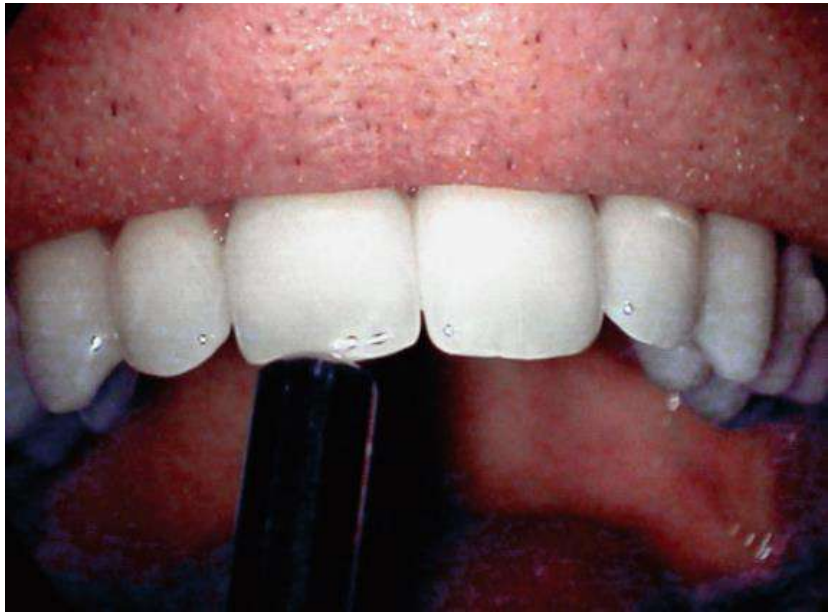

The indication of where the pain originates is interpreted by the mesencephalic nucleus, receiving information from proprioceptive nerve receptors
Few proprioceptors in the dental pulp
Prevalent in the periodontal ligament spaces
Difficult for the patient to discriminate the location of dental pain in the earlier stages of pathosis
Disease state extends into the periodontal ligament space, pain becomes more localized for the patient


Presence of acute symptoms may create anxiety and possibly alter the patient's response, properly preparing the patient will lead to more accurate result
The contralateral tooth should first be tested as a control, as should several adjacent teeth that are certain to respond normally
Patient is informed that sensation from this tooth is normal and asked indicate any tenderness or pain from subsequent teeth

- Performed by tapping on the incisal or occlusal surfaces of the teeth either with the finger or blunt instrument

- Initially testing is done gently, with light pressure being applied digitally with a gloved finger tapping

- If the patient cannot detect significant difference between any of the teeth, the test is repeated using the blunt end of an instrument



Percussion testing of a tooth, using the back end of a mirror handle

- Does not disclose the condition of the pulp – indicates the presence of a periradicular inflammation

- Positive response indicates inflammation of the periodontal ligament

- The sensitivity of the proprioceptive fibers in an inflamed periodontal ligament will help identify the location of the pain

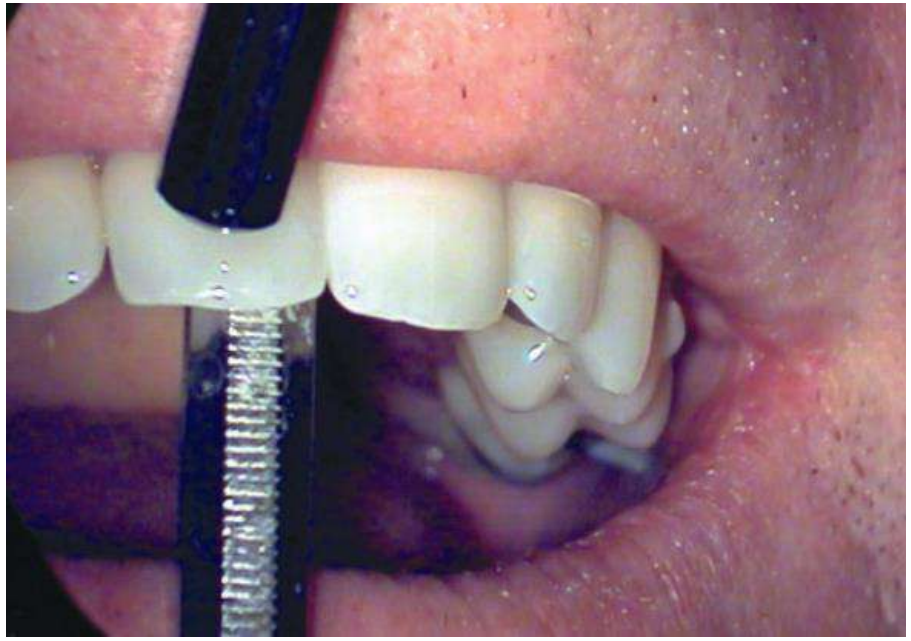
- **Mobility**
- Indication of a compromised periodontal attachment apparatus
- This compromise could be the result of

1. Acute or chronic physical trauma,
2. Occlusal trauma,
3. Parafunctional habits,
4. Periodontal disease,
5. Root fractures,
6. Rapid orthodontic movement, or
7. Extension of pulpal disease, specifically an infection, into the periodontal ligament space

- Directly proportional to the integrity of the attachment apparatus or to the extent of inflammation in the periodontal ligament

- Often the mobility reverses to normal after causative factors are eliminated

- Back ends of two mirror handles should be used, one on the buccal aspect and one on the palatal/lingual aspect of the tooth



Mobility testing of a tooth, using the back ends of two mirror handles

- Pressure is applied in a facial-lingual direction as well as in a vertical direction and the tooth mobility is scored

Grade	Mobility
Grade 1	The first distinguishable sign of movement greater than normal
Grade 2	Horizontal tooth movement no greater than 1 mm
Grade 3	Horizontal tooth movement greater than 1 mm, with or without the visualization of rotation or vertical depressability

- Any mobility that exceeds +1 should be considered abnormal

Pulp Tests

- Two types of pulpal tests

1. **Neural Sensibility Tests -** Tests to determine whether the pulpal nerves are functional – obtain a subjective response from the patient
2. **Pulp Vascularity Tests -** Tests that detect the integrity of the pulpal vasculature – objective approach

Neural Sensibility Tests

1. Thermal Tests

- Cold Test
- Heat Test

2. Electric Pulp Tests

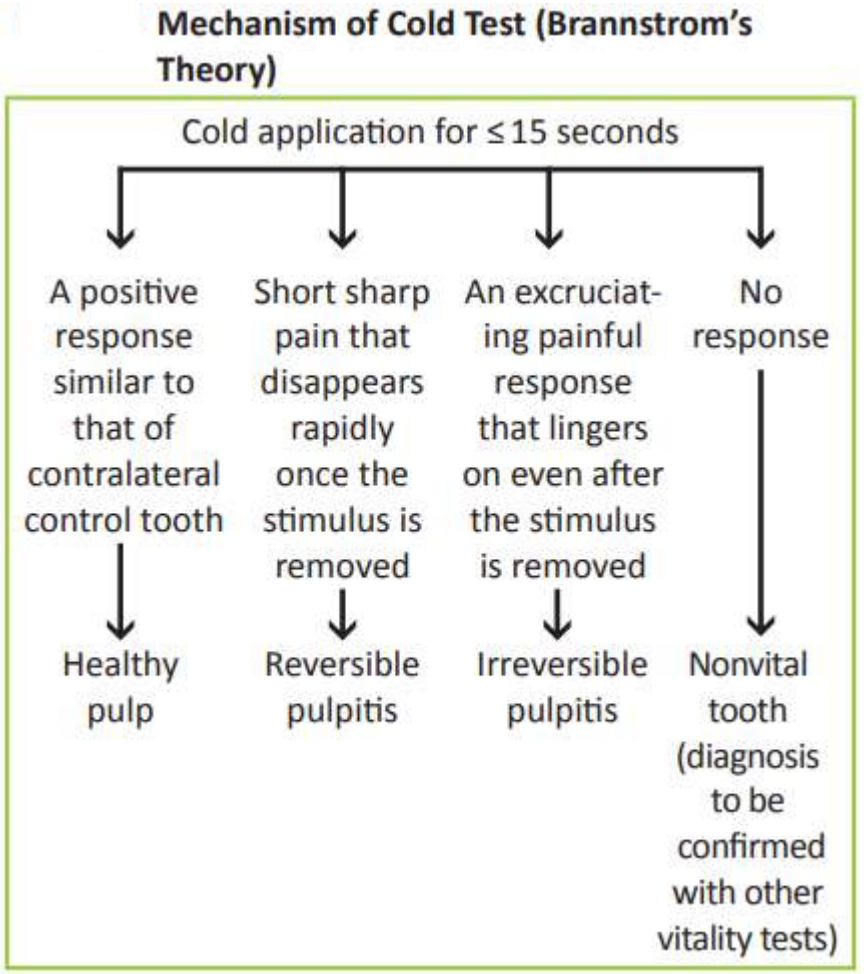
Thermal Tests

- Include Cold and Heat tests
- The baseline or normal response is a patient's report that a sensation is felt but disappears immediately upon removal of the thermal stimulus
- **Abnormal responses include**

1. Lack of response to the stimulus
2. Lingering or intensification of a painful sensation after the stimulus is removed, or
3. An immediate, excruciatingly painful sensation as soon as the stimulus is placed on the tooth

Cold Tests:

- Primary pulp testing method used by clinicians
- Rubber dam is recommended, if the test is performed with stick of ice
- **Frozen carbon dioxide (CO2),** also known as **dry ice** or **carbon dioxide snow,** or **CO2 stick**, has been found to be reliable in eliciting a positive response if vital pulp tissue is present in the tooth



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The teeth isolated and the oral soft tissues – protected so the frozen CO_2 will not come into contact with these structures

Extremely cold temperature of the frozen CO2 (−69°F to −119°F; −56°C to −98°C), burns of the soft tissues can occur

CO_2 stick is applied to the facial surface of the natural tooth structure

Application of CO_2 to teeth does not result in any irreversible damage to the pulp tissues or cause any significant enamel crazing

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Most popular method of performing cold test is with a refrigerant spray

Advantages:

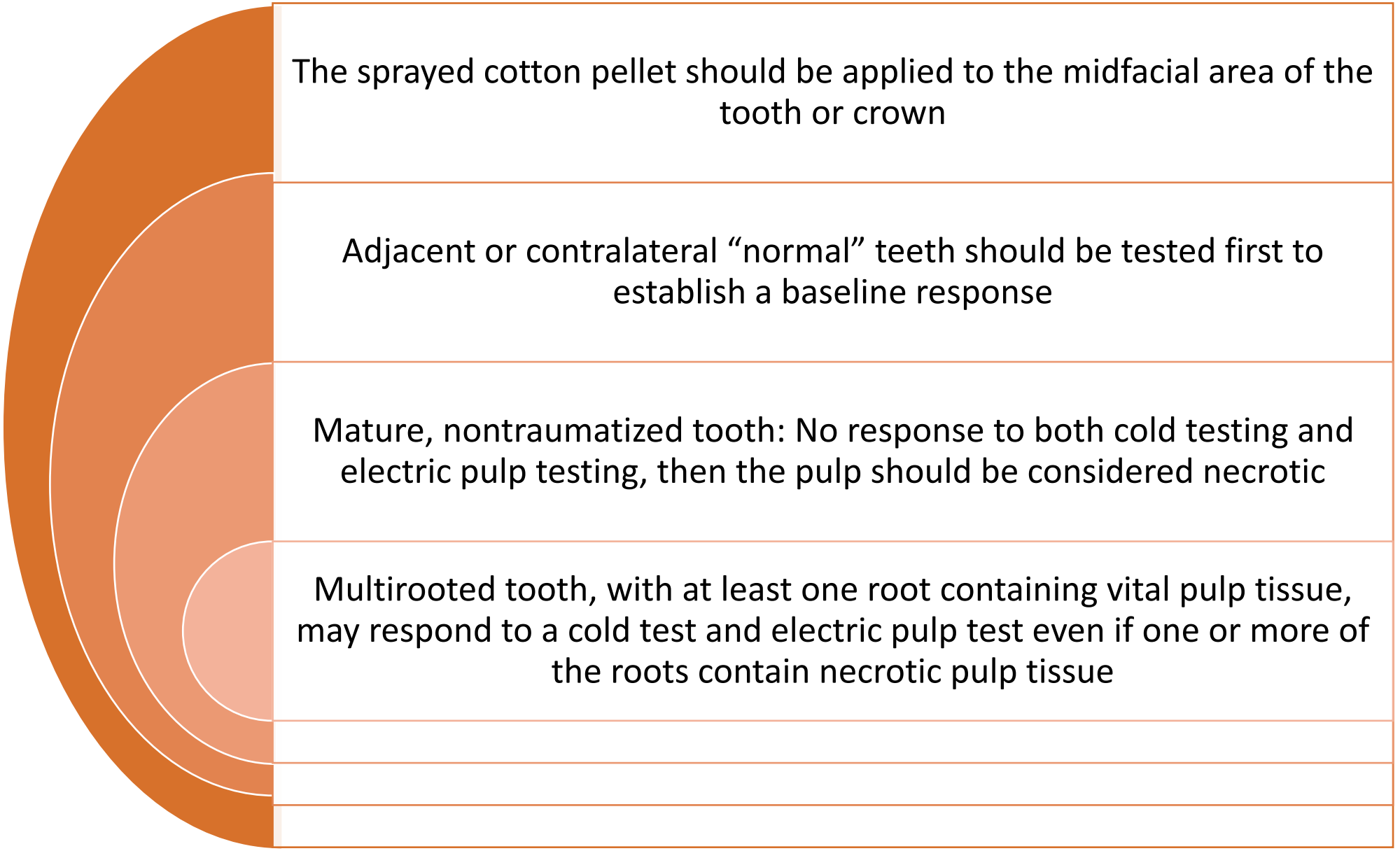
- Readily available
- Easy to use
- Provides test results that are reproducible, reliable, and equivalent to that of frozen CO_2

Contains 1,1,1,2-tetrafluoroethane, which has zero ozone depletion potential and is environmentally safe

It has a temperature of −26.2°C

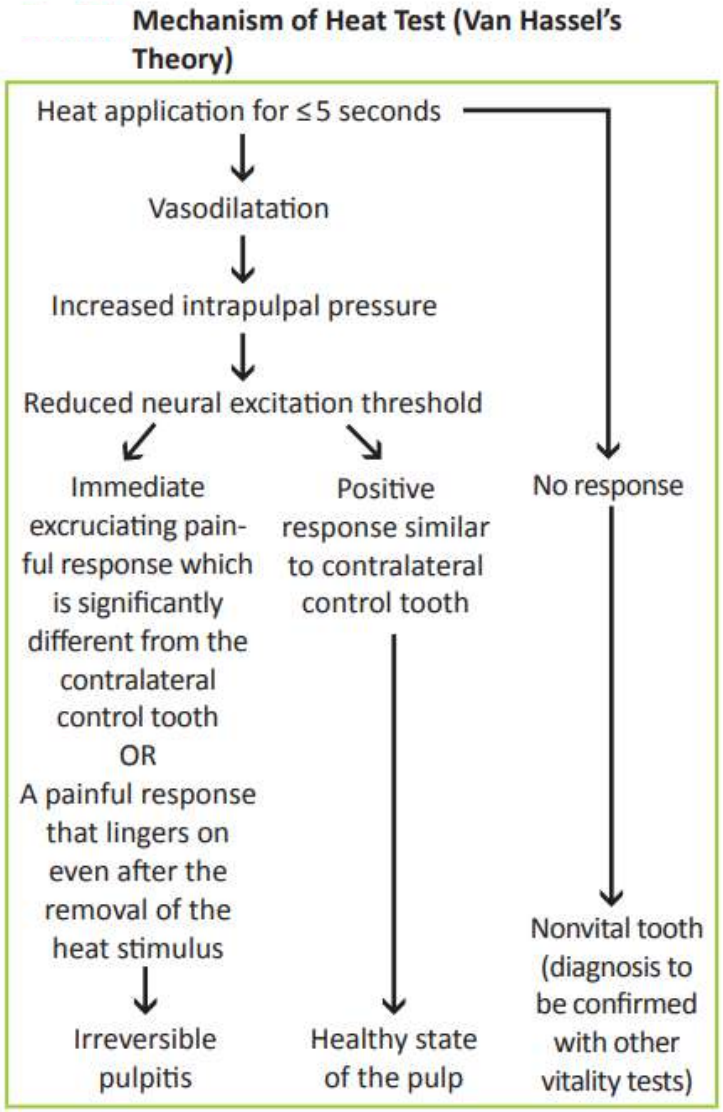
The spray is most effective for testing purposes when it is applied to the tooth on a large cotton pellet

Refrigerant spray container


The sprayed cotton pellet should be applied to the midfacial area of the tooth or crown
Adjacent or contralateral “normal” teeth should be tested first to establish a baseline response
Mature, nontraumatized tooth: No response to both cold testing and electric pulp testing, then the pulp should be considered necrotic
Multirooted tooth, with at least one root containing vital pulp tissue, may respond to a cold test and electric pulp test even if one or more of the roots contain necrotic pulp tissue

- **Heat Tests**
- Most useful when a patient's chief complaint is intense dental pain on contact with any hot liquid or food
- Patient unable to identify which tooth is sensitive, a heat test is appropriate

1. Hot Water under rubber dam isolation
2. Heated gutta percha stick
3. Hot ball burnisher
4. Dry rubber polishing wheel
5. Electrical heat carrier



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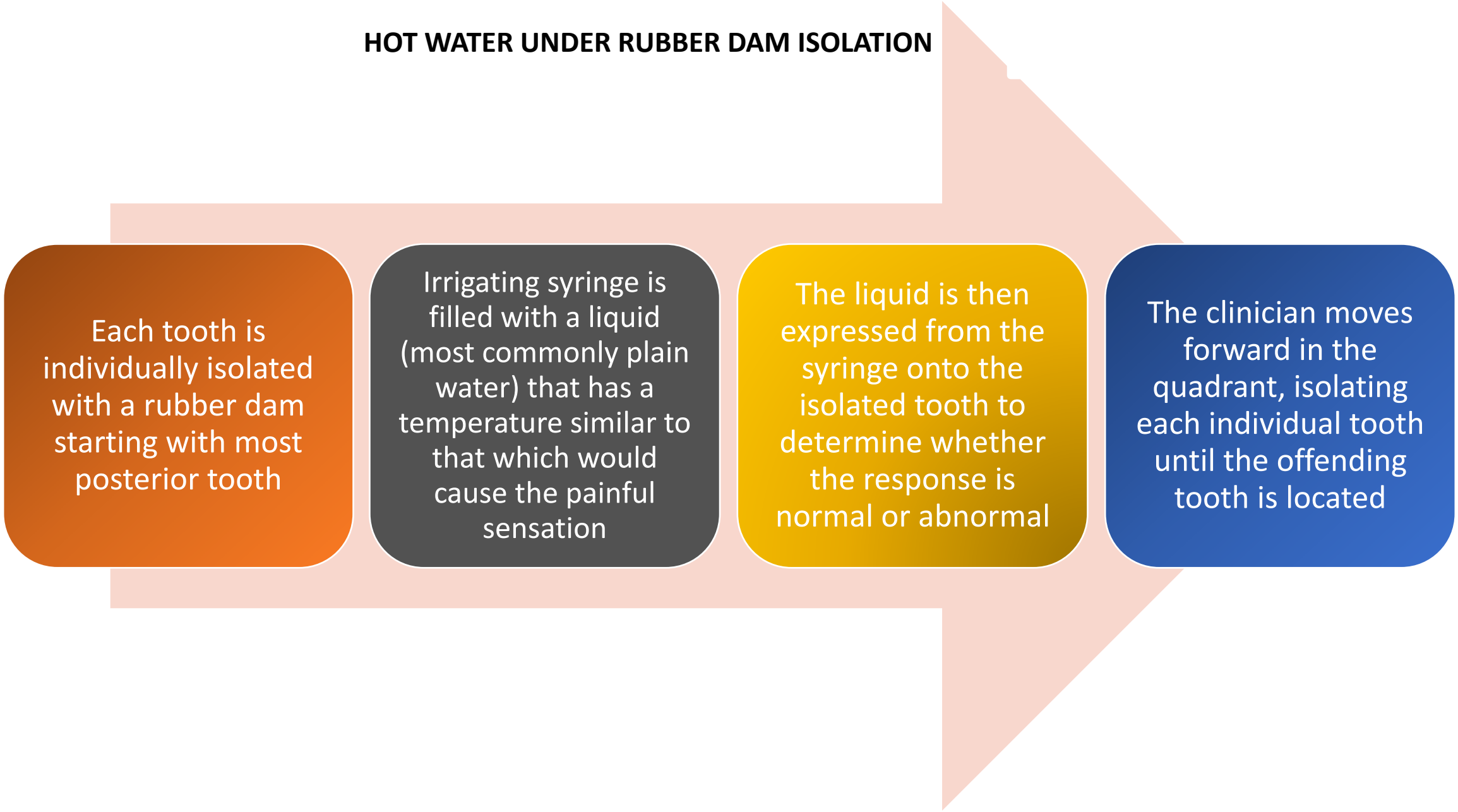
HOT WATER UNDER RUBBER DAM ISOLATION



HEATED GUTTAPERCHA OR COMPOUND STICK

- Light layer of lubricant should be placed onto the tooth surface before applying the heated material to prevent the hot gutta-percha or compound from adhering to the dry tooth surface

Applying heated gutta-percha stick to the tooth surface

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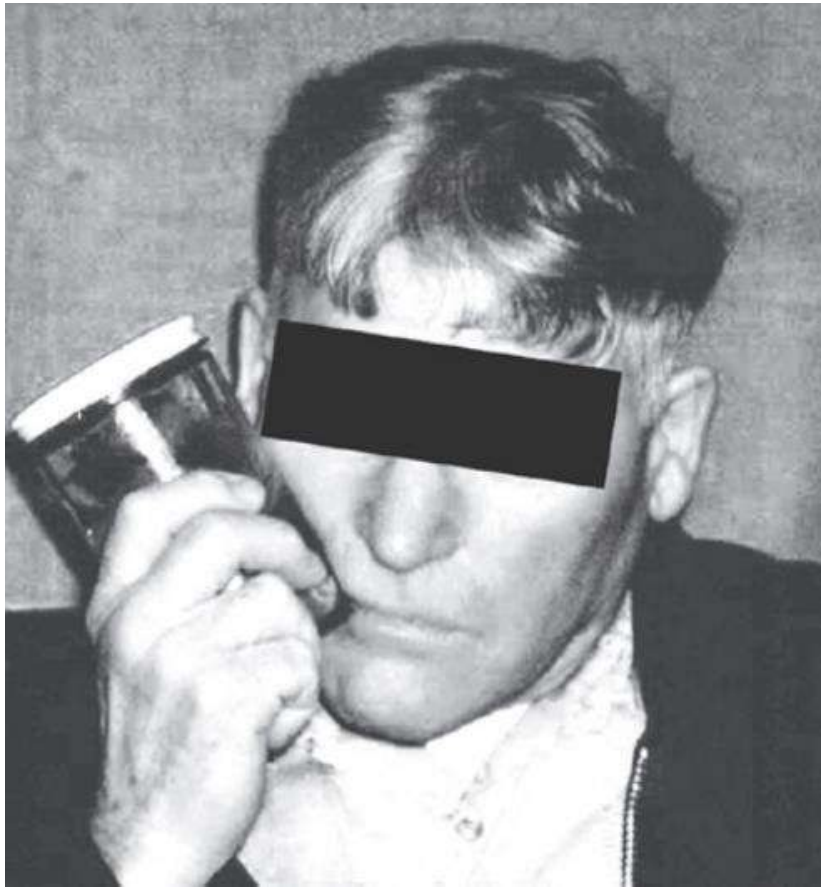
Grossman's Endodontic Practice 13th Edition

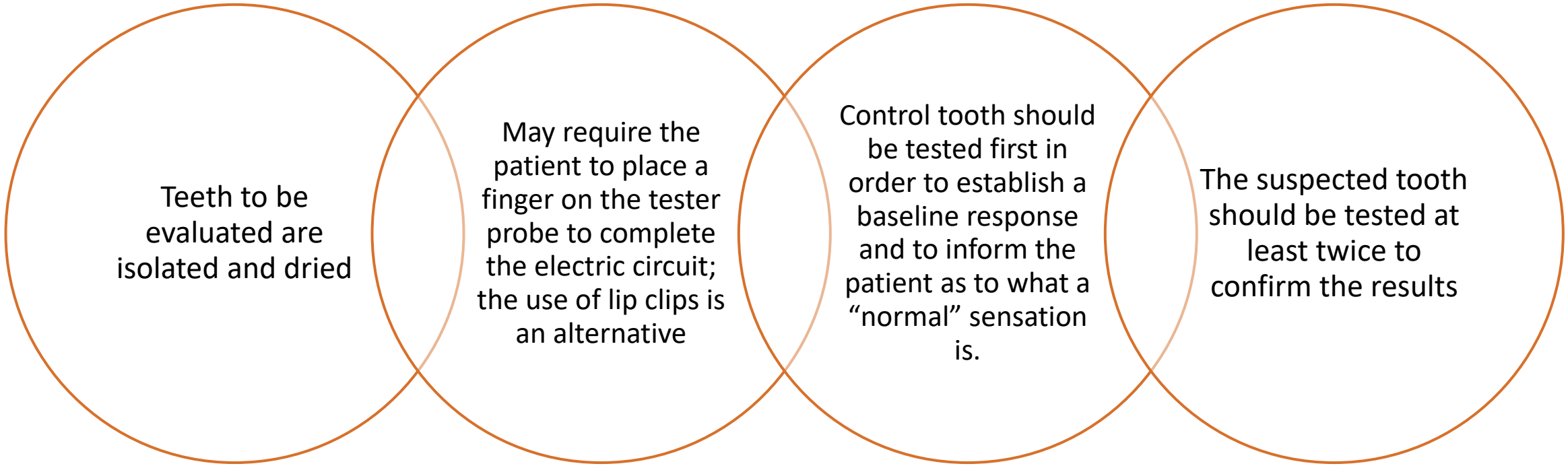
- Often a tooth that is sensitive to heat is responsible for spontaneous pain
- The patient may present with cold liquids in hand just to minimize the pain
- Application of cold to a specific tooth may eliminate the pain and greatly assist in the diagnosis.
- **Tooth that responds to heat and then is relieved by cold is necrotic**



Patient has found that the only way to alleviate the pain is to place a jar filled with ice water against the right side of his face

Electric Pulp Tests

- Assessment of pulp neural responses
- Vitality of the pulp is determined by the intactness and health of the vascular supply, not by the status of the pulpal nerve fibers
- A response to the electric current only denotes that some viable nerve fibers are present in the pulp and are capable of responding


Teeth to be evaluated are isolated and dried
May require the patient to place a finger on the tester probe to complete the electric circuit; the use of lip clips is an alternative
Control tooth should be tested first in order to establish a baseline response and to inform the patient as to what a “normal” sensation is.
The suspected tooth should be tested at least twice to confirm the results

- The tip of the testing probe – placed in contact with the tooth structure is coated with a water- or petroleum-based medium
- Most commonly used medium is toothpaste
- Coated probe tip is placed at incisal third on the facial or buccal area of the tooth to be tested
- Most accurate results when no response is obtained to any amount of electric current
- This response most frequently found when a necrotic pulp is present

Potential Common Interpretation Errors of Responses Obtained from Electric Pulp Testing

False-Positive Responses

Partial pulp necrosis
Patient's high anxiety
Ineffective tooth isolation
Contact with metal restorations

False-Negative Responses

Calcific obliterations in the root canals
Recently traumatized teeth
Immature apex
Drugs that increase patient's threshold for pain
Poor contact of pulp tester to tooth

Studies by Peters DD, et al. (1994) Petersson K, et al. (1999) have indicated there is no significant difference between pulp testing results obtained by electric pulp tester and those obtained by the thermal methods.

Cold tests – more reliable than electric pulp tests in younger patients with less developed root apices

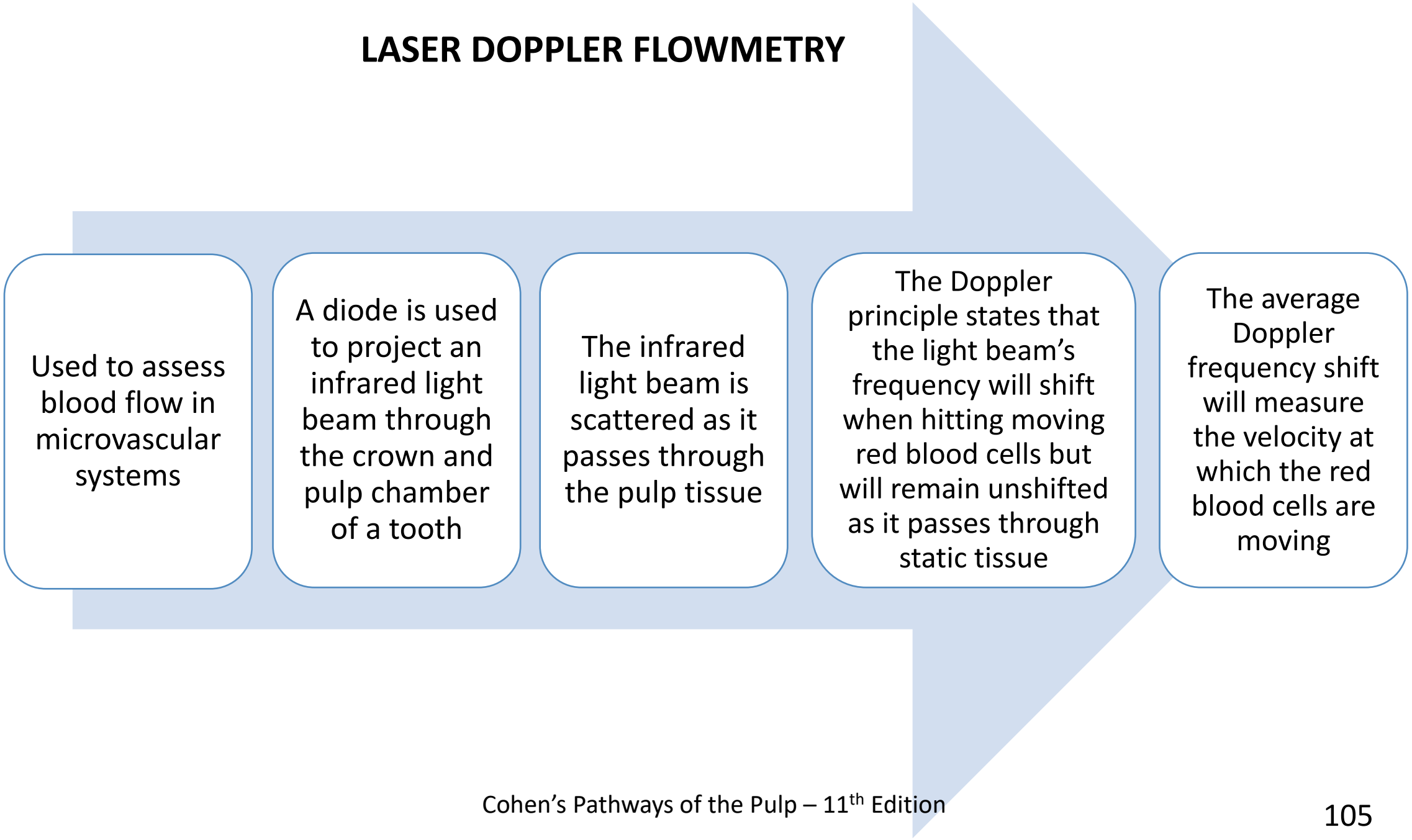
Thus results obtained by one testing method should be compared and verified with results obtained by other methods

Pulp Vascularity Tests

1. Laser Doppler Flowmetry
2. Pulp Oximetry
3. Recent Technologies

- Crown Surface Temperature and Thermography
- Transmitted Light Photoplethysmography / Tooth Plethysmography

LASER DOPPLER FLOWMETRY



Studies by Ingolfsson AER, et al., (1994) and Evans D, et al., (1999) have found LDF to be an accurate, reliable, and reproducible method of assessing pulpal blood flow.

Advantages: Data collected based on objective findings rather than subjective patient responses

LDF has been shown to be a great indicator for pulpal vitality in trauma cases

PULSE OXIMETRY

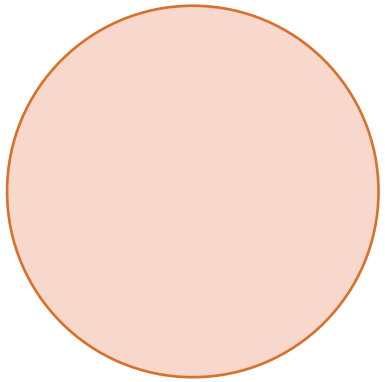
- Noninvasive device
- Designed to measure the oxygen concentration in the blood and the pulse rate
- **Mechanism:** Transmits two wavelengths of light, **red and infrared,** through a translucent portion of a patient's body (e.g., a finger, earlobe, or tooth).
- Some light is absorbed as it passes through the tissue
- Amount of light absorbed depends on the ratio of oxygenated to deoxygenated hemoglobin in the blood

Nellcor OxiMax N-600x pulse oximeter

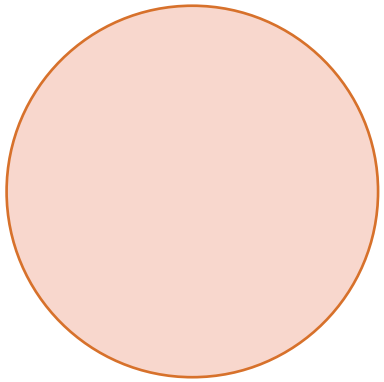
- On the opposite side of the targeted tissue, a sensor detects the absorbed light
- On the basis of the difference between the light emitted and the light received, a microprocessor calculates the pulse rate and oxygen concentration in the blood
- The transmission of light to the sensor requires that there be no obstruction from restorations, which can sometimes limit the usefulness of pulse oximetry to test pulp vitality

- Custom-made sensors were developed and found to be more accurate than electric and thermal pulp tests. [Gopikrishna V et. Al., (2007) Dastmalchi N, et al., (2012)]
- Especially useful in evaluating teeth that have been subjected to traumatic injuries, with questionable vitality using conventional pulp testing methods

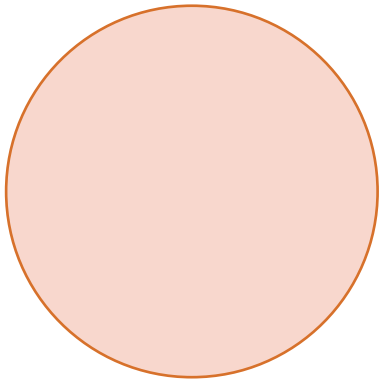
Crown Surface Temperature and Thermography



Temperature measurement/ Thermography, is a diagnostic procedure for human teeth, has been described with the use of thermistors, infrared thermography, and liquid crystals



Cholesteric liquid crystals, which exhibit different colours when heated, have been previously employed to determine pulp vitality



The underlying principle was that teeth with an intact pulp blood supply (vital/ healthy pulp tissue) had a warmer tooth surface temperature compared with teeth that had no blood supply

Gopikrishna V, Pradeep G, Venkateshbabu N. Assessment of pulp vitality: a review. International journal of paediatric dentistry. 2009 Jan;19(1):3-15.

Crown Surface Temperature and Thermography

Surface temperature of teeth is measured over a period of time at 15 s intervals using an electric thermometer attached to a surface probe, placed in contact with the tooth

It has been used to demonstrate that, following cooling, only vital teeth showed a subsequent rise in surface temperature and nonvital teeth were slower to rewarm than vital teeth

Disadvantage: Teeth must be isolated with rubber dam, after which a period of acclimatization is necessary prior to imaging

The technique is complex and requires the subjects to be at rest for 1 h prior to testing

Gopikrishna V, Pradeep G, Venkateshbabu N. Assessment of pulp vitality: a review. International journal of paediatric dentistry. 2009 Jan;19(1):3-15.

Transmitted light photoplethysmography / Tooth Plethysmography

TLP is a non-invasive technique used to monitor pulpal blood flow – successfully applied in animal and human studies

It has been suggested that TLP incurs less signal contamination from the periodontal blood flow than is the case for LDF

The tooth plethysmogram (PPG), reflects blood pressure variations in the pulp tissue provide an absolute indication of pulp vitality

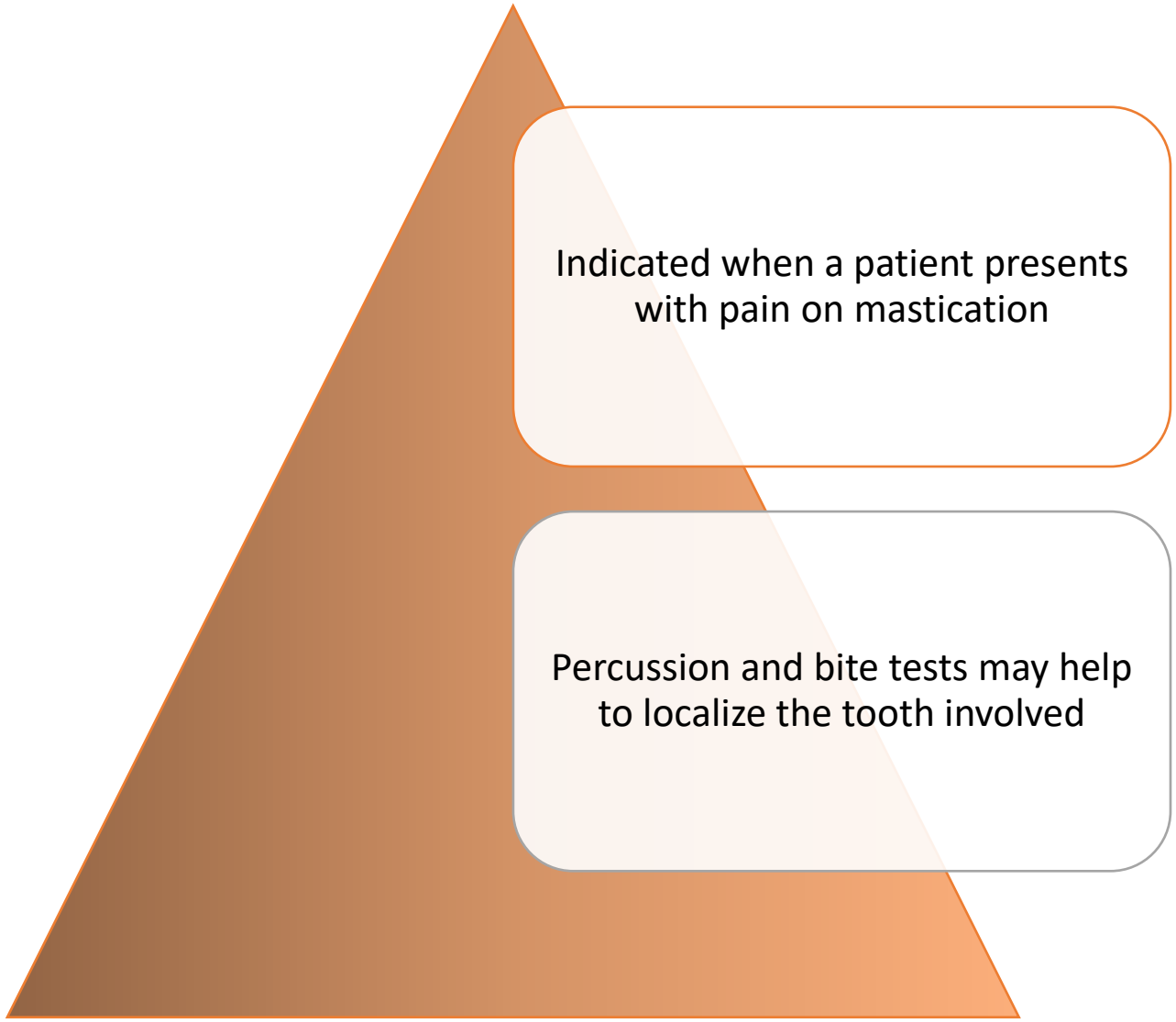
Detection of optical density fluctuations that are synchronous with systolic contractions of the heart provides strong evidence of pulp tissue perfusion and vitality

Gopikrishna V, Pradeep G, Venkateshbabu N. Assessment of pulp vitality: a review. International journal of paediatric dentistry. 2009 Jan;19(1):3-15.
Schmitt JM, Webber RL, Walker EC. Optical determination of dental pulp vitality. IEEE transactions on biomedical engineering. 1991 Apr;38(4):346-52.

Special Tests

1. Bite Tests
2. Test Cavity
3. Staining
4. Selective Anesthesia

Bite Test



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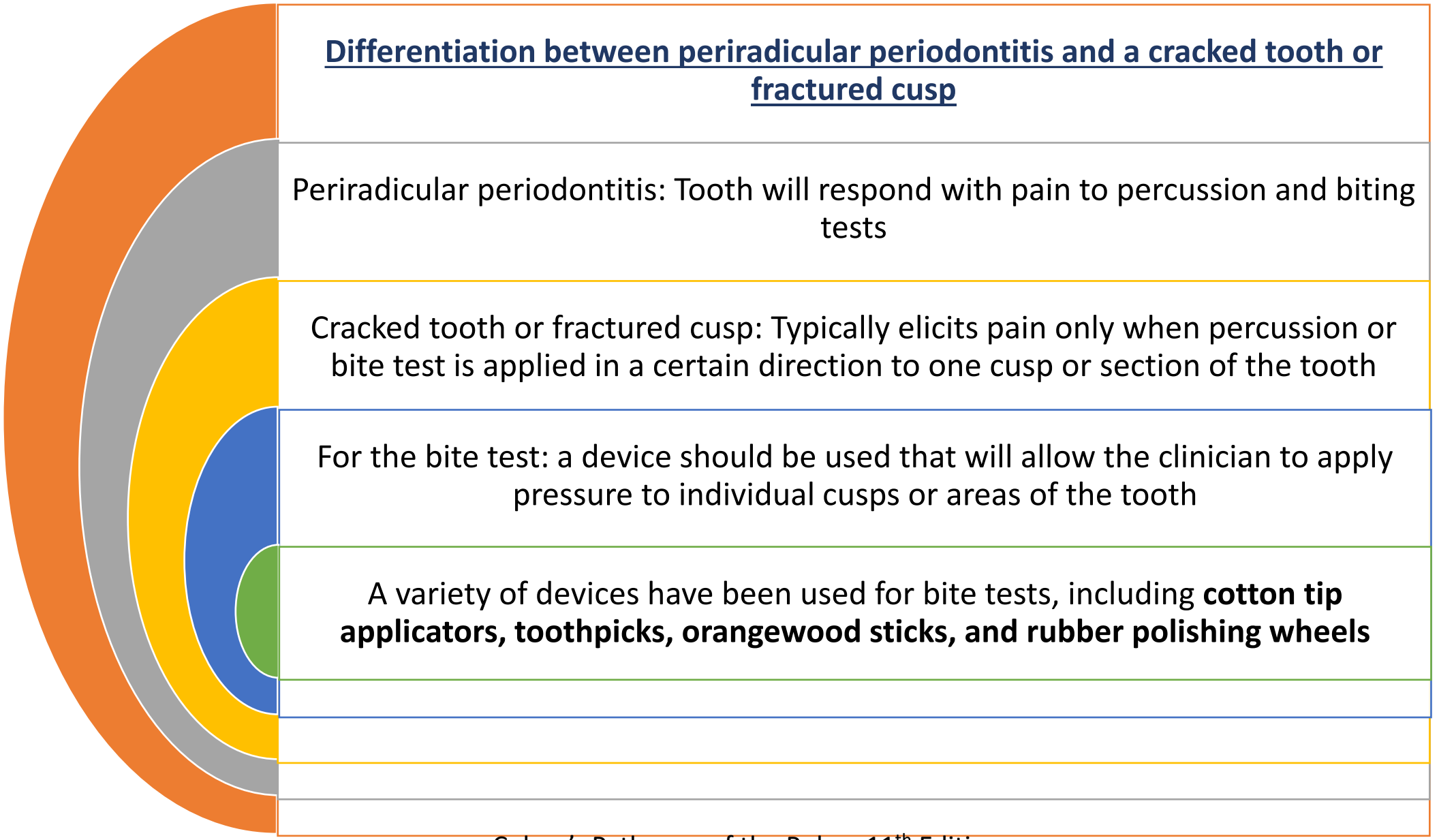

Differentiation between periradicular periodontitis and a cracked tooth or fractured cusp
Periradicular periodontitis: Tooth will respond with pain to percussion and biting tests
Cracked tooth or fractured cusp: Typically elicits pain only when percussion or bite test is applied in a certain direction to one cusp or section of the tooth
For the bite test: a device should be used that will allow the clinician to apply pressure to individual cusps or areas of the tooth
A variety of devices have been used for bite tests, including cotton tip applicators, toothpicks, orangewood sticks, and rubber polishing wheels

There are several devices specifically designed to perform bite test

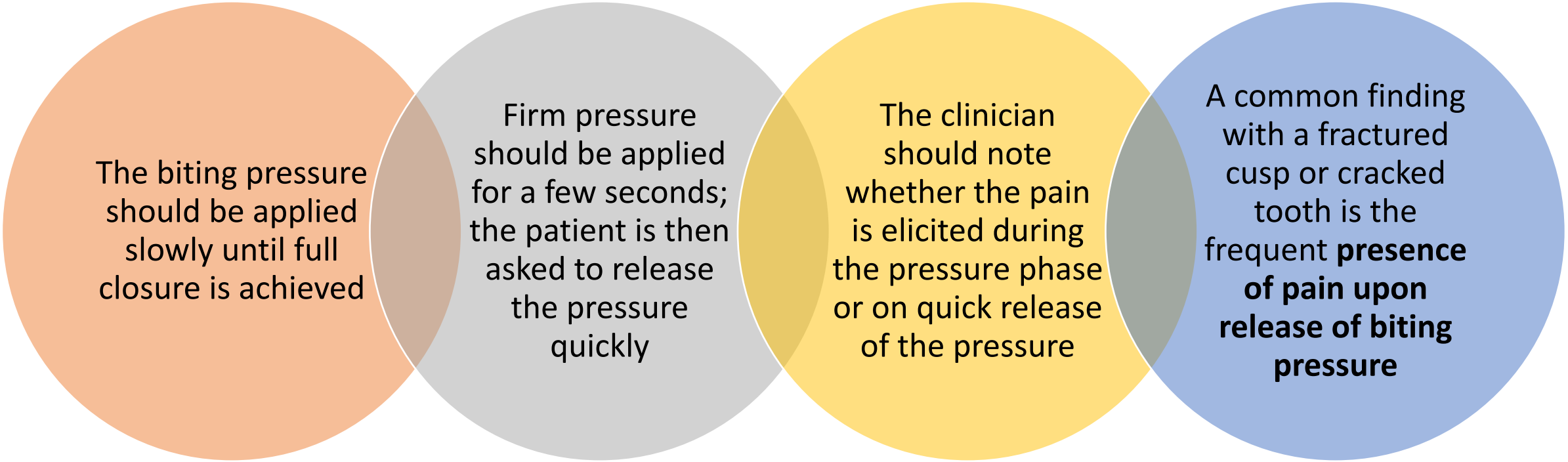
Tooth Slooth and FracFinder are two of the commercially available devices used for the bite test

Adjacent and contralateral teeth should be used as controls so that the patient is aware of the “normal” response to these tests

The small cupped-out area on these instruments is placed in contact with the cusp to be tested

The patient is then asked to apply biting pressure with the opposing teeth to the flat surface on the opposite side of the device

To determine which tooth, or tooth part, is sensitive to mastication, having the patient bite on a specially designed bite stick is often helpful.


The biting pressure should be applied slowly until full closure is achieved
Firm pressure should be applied for a few seconds; the patient is then asked to release the pressure quickly
The clinician should note whether the pain is elicited during the pressure phase or on quick release of the pressure
A common finding with a fractured cusp or cracked tooth is the frequent **presence of pain upon release of biting pressure**

TEST CAVITY

Invasive test

Used only when all other test methods are deemed impossible or the results of the other tests are inconclusive

High-speed with round bur, proper air and water coolant used

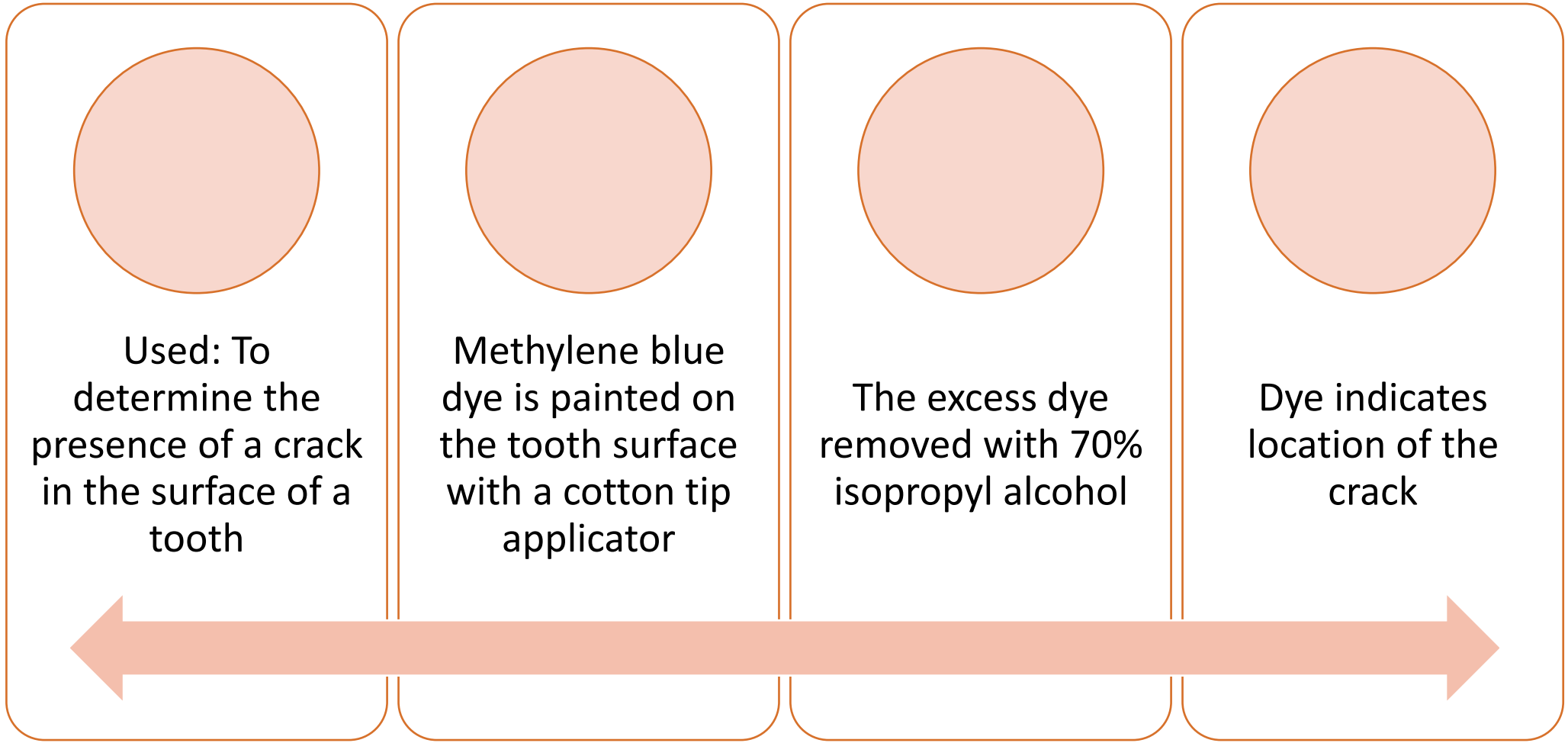
The patient not anesthetized while this procedure is performed, asked to respond if any painful sensation is felt during the drilling procedure

If the patient feels pain once the bur contacts sound dentin, the procedure is terminated and the class I cavity preparation is restored

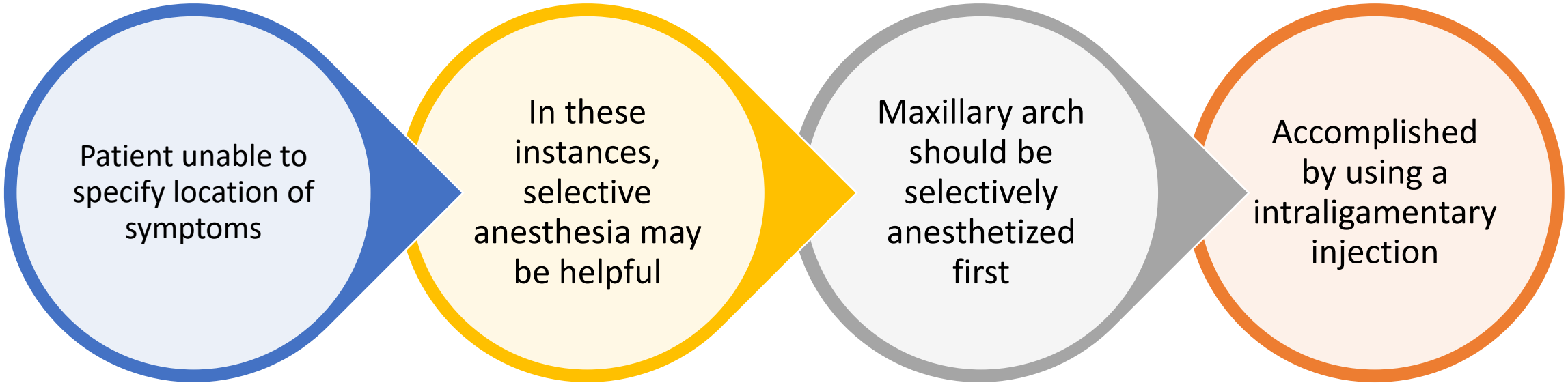
This sensation signifies only that there is some viable nerve tissue remaining in the pulp, not that the pulp is totally healthy

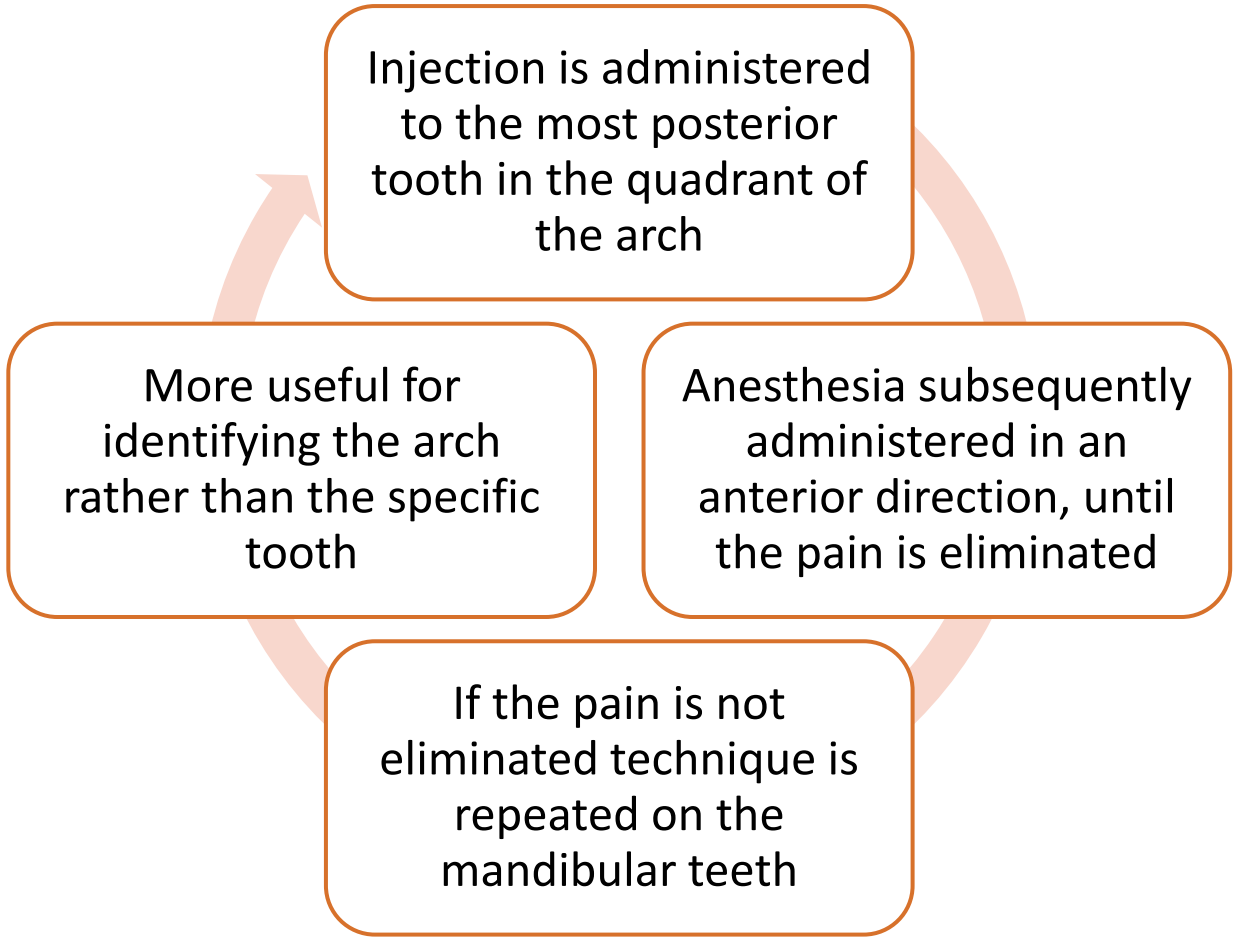
If the patient fails to feel any sensation when the bur reaches the dentin, this is a good indication that the pulp is necrotic and root canal therapy is indicated

STAINING


Used: To determine the presence of a crack in the surface of a tooth
Methylene blue dye is painted on the tooth surface with a cotton tip applicator
The excess dye removed with 70% isopropyl alcohol
Dye indicates location of the crack

SELECTIVE ANESTHESIA




Injection is administered to the most posterior tooth in the quadrant of the arch
Anesthesia subsequently administered in an anterior direction, until the pain is eliminated
If the pain is not eliminated technique is repeated on the mandibular teeth
More useful for identifying the arch rather than the specific tooth

The Stressed Pulp

- Abou-Rass has directed the attention of the profession to “the stressed pulp”
- This is the pulp that over the years has been stressed by both disease and treatment
- And when this tooth is to be used as an abutment for a partial denture, more iatral insults follow
- Tooth is reduced again, heated up, cooled off, and injured by impressions, try-ins, and temporaries
- The final insult is permanent cementation followed by microleakage

- These stressed pulps finally give up by either aching and dying or just quietly dying
- The tooth which is now covered by new restoration will have to be weakened or destroyed to reach the ailing pulp
- Abou-Rass stated that in such teeth it is better to determine the quality of life of the pulp before treatment and take action before and not after, the final commitment is made

Radiographic Examination and Interpretation

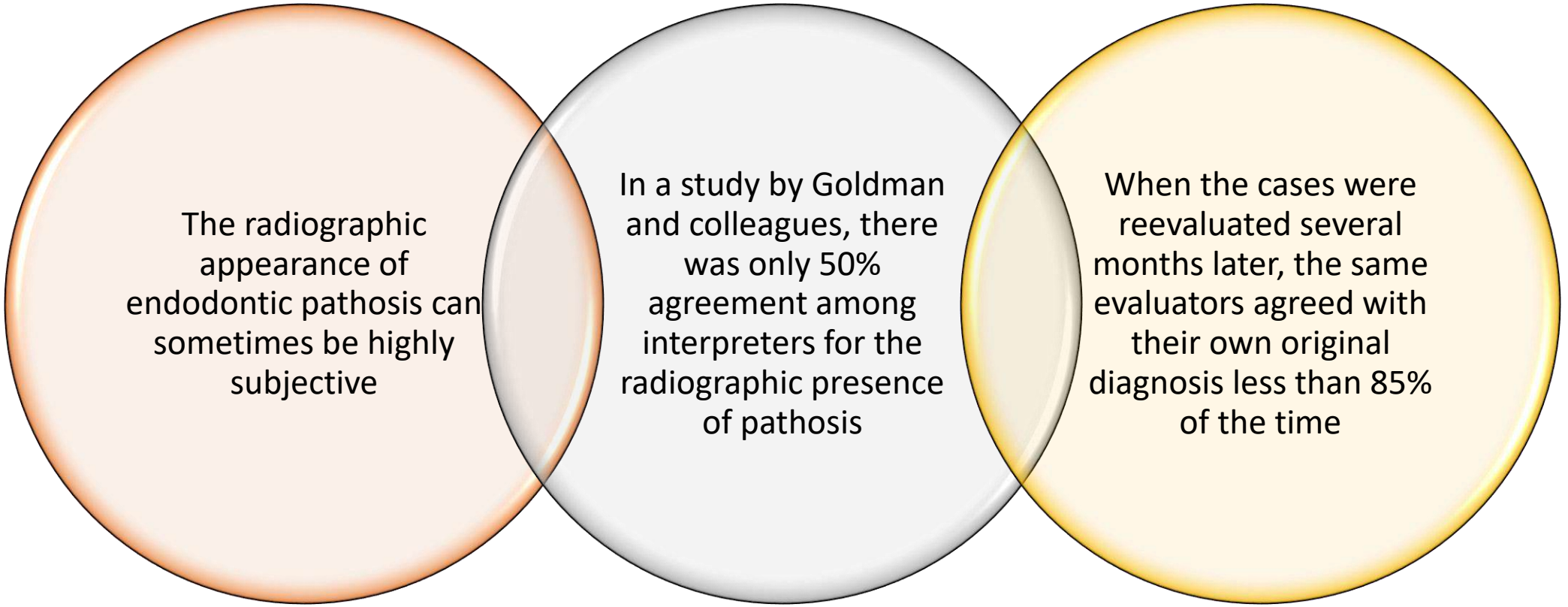
1. Intraoral Radiographs
2. Digital Radiography
3. Cone-Beam Computerized Tomography
4. Xeroradiography
5. OPG
6. Magnetic Resonance Imaging (MRI)

INTRAORAL RADIOGRAPHS

Sequence of examination radiographic evaluations should come last

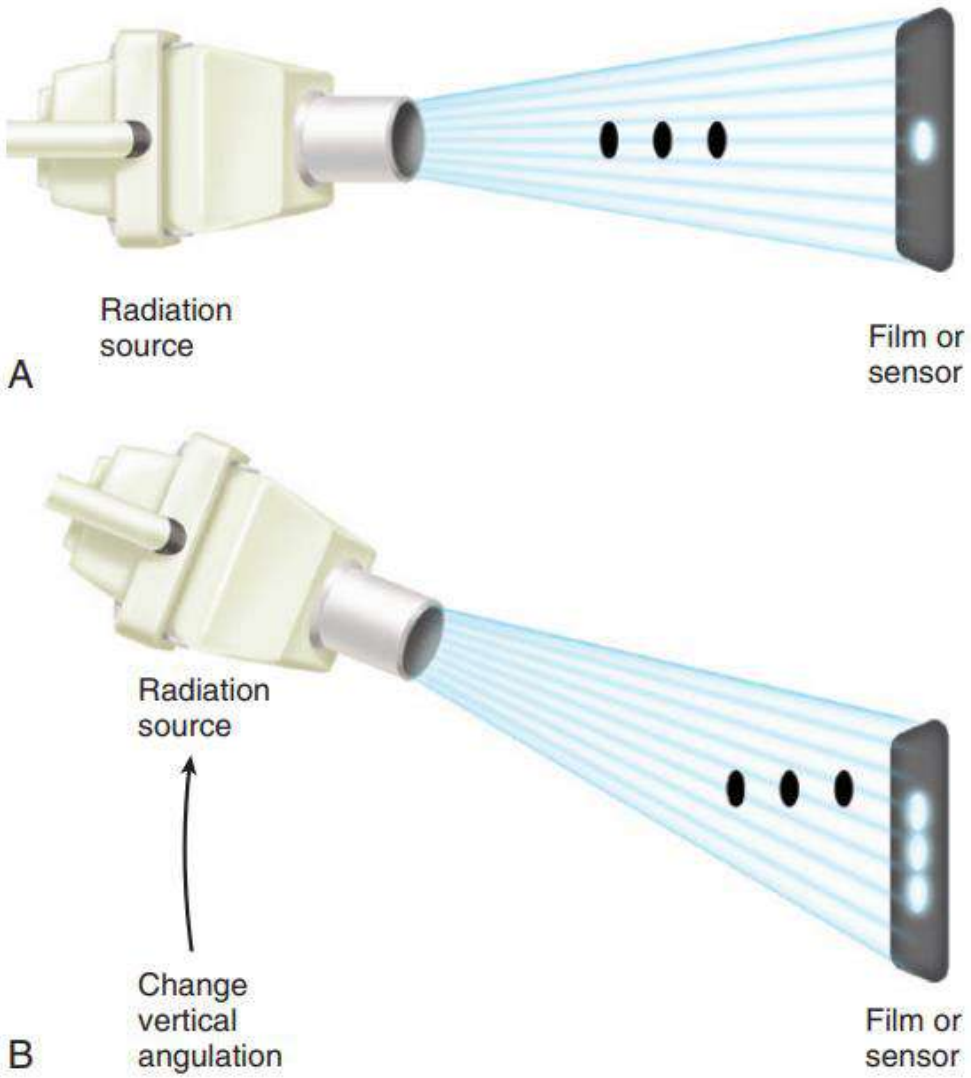
Radiograph should be used only as a sign, providing important clues in the diagnostic investigation

JOHN I. INGLE – Endodontics 5th Edition
Cohen's Pathways of the Pulp – 11th Edition


The radiographic appearance of endodontic pathosis can sometimes be highly subjective
In a study by Goldman and colleagues, there was only 50% agreement among interpreters for the radiographic presence of pathosis
When the cases were reevaluated several months later, the same evaluators agreed with their own original diagnosis less than 85% of the time

- Radiographs at different angulations necessary to determine the presence of

1. Multiple roots and multiple canals
2. Restoration defects
3. Root fractures and
4. The extent of root maturation and apical development



Radiographic images are only two-dimensional difficult determine location of overlapping objects

A, Source of radiation perpendicular to overlapping objects, the image is captured without much separation of the objects.

B, Radiation source at an angle to offset the overlapping objects, the image is captured with the objects being viewed as separated.

- Endodontic pathosis radiographically, appears as bone loss in the area of the periapex
- The pathosis may present merely as a widening or break in the lamina dura
- May also present as a radiolucent area at the apex of the root
- On occasion there may be no radiographic change at all, even in the presence of a disease process in the alveolar bone

The apices of most anterior and premolar teeth are located close to the cortical-cancellous bone junction

Periapical pathosis from these teeth is exhibited sooner on the radiograph

Distal roots of mandibular first molars and both roots of mandibular second molars, palatal roots maxillary molars – positioned more centrally within the cancellous bone

Periapical lesions from these roots must expand more before they reach the cortical-cancellous bone junction and are recognized as radiographic pathosis

DIGITAL RADIOGRAPHY

- Available since the late 1980s
- Significant advantages of digital radiographs over conventional radiographs include

1. Lower radiation doses
2. Instant viewing
3. Convenient manipulation
4. Efficient transmission of an image via the Internet
5. Easy archiving

A sensor is used to capture the image created by the radiation source

More sensitive to radiation than conventional x-ray film and require 50% to 90% less radiation to acquire an image

Directly or wirelessly attached to a local computer, which interprets this signal and, using specialized software, translates the signal into a two-dimensional digital image that can be displayed

The image is stored in the patient's file in a dedicated network server and can be recalled as needed

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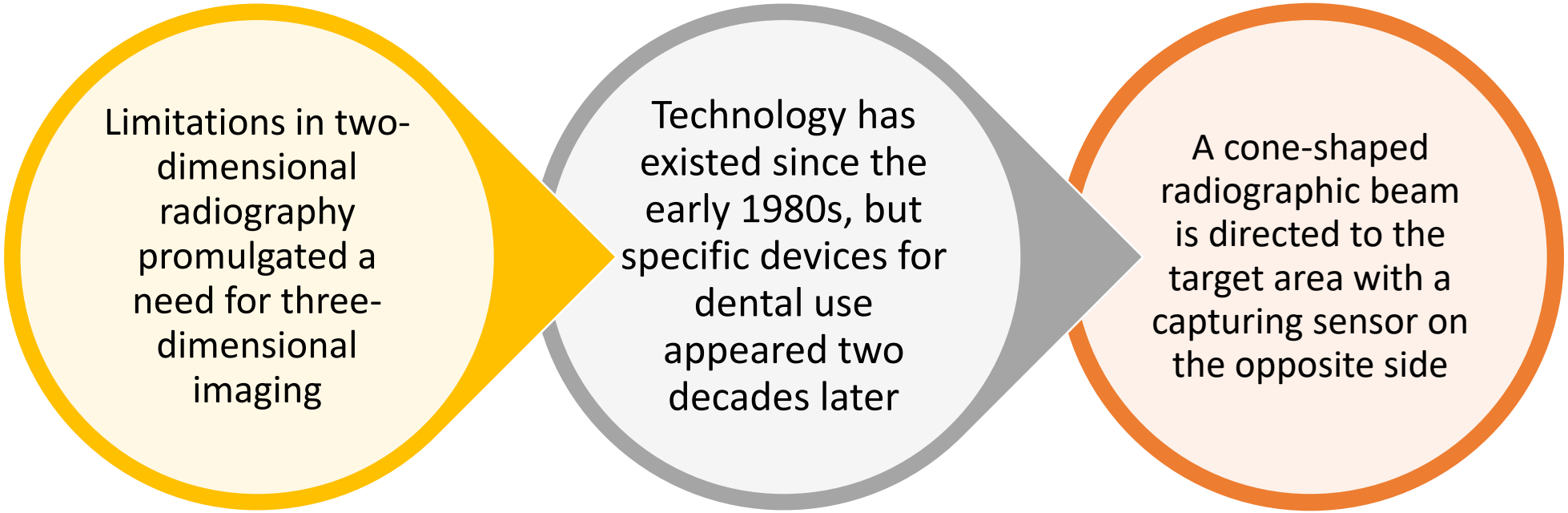
Cone Beam Computed Tomography

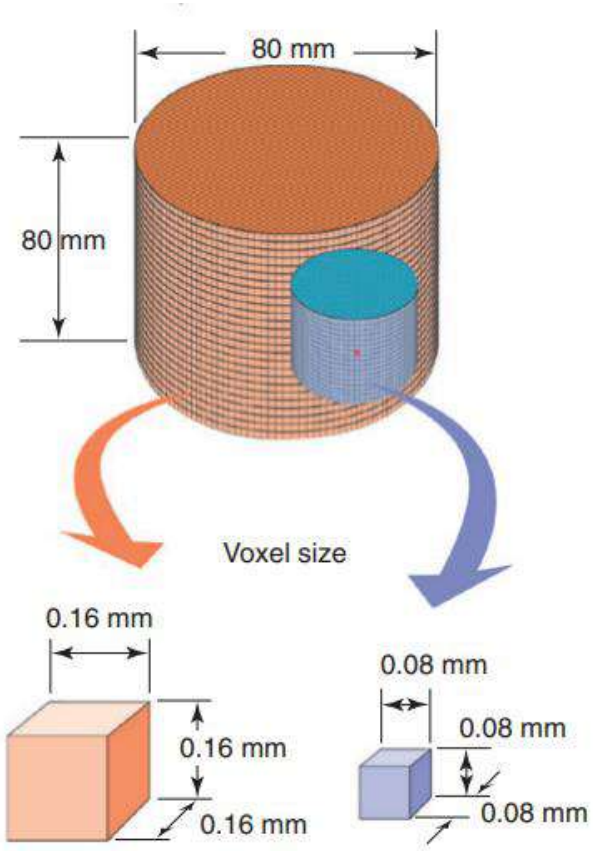


Cone-beam volumetric tomography

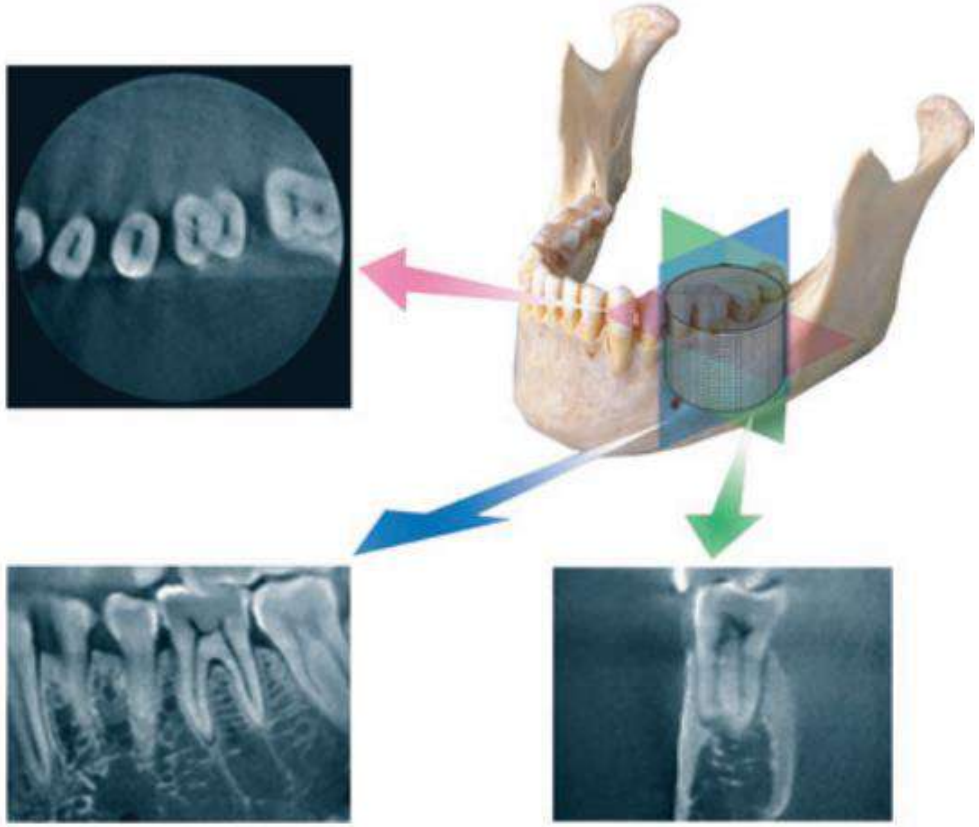
- Conventional digital dental radiography is captured and interpreted as pixels – a series of dots

- For CBCT, the image is instead captured as a series of three-dimensional pixels, known as voxels

- Combining these voxels gives a three-dimensional image that can be "sliced" into various planes: Axial, Sagittal and Coronal



Cohen's Pathways of the Pulp – 11th Edition



Cone-beam volumetric tomography has the advantage of being able to detect pathosis in the bone or associated with the teeth without the obstruction of anatomic structures. The planes of vision may be axial, sagittal, or coronal.

Treatment Planning and Case Selection

Treatment Planning and Case Selection

- Establishing Treatment Plan

- Best interests served by – retention, or extraction and replacement

- Affected by an array of dental and nondental variables

- The patient's health status
- Endodontic prognosis
- Motivation
- Economic factors all play a role in determining the ultimate treatment plan

- **Periodontal status, restorability of the tooth, and prognosis of the proposed plan must all be considered**

Medical Consideration

ASA PS Classification	Definition	Examples, Including, But Not Limited to
ASA I	A normal healthy patient	Healthy, nonsmoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. E.g. Current smoker, social alcohol drinker, well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; one or more moderate to severe diseases. E.g. Poorly controlled DM or HTN, COPD, hepatitis, alcohol dependence or abuse

ASA PS Classification	Definition	Examples, Including, But Not Limited to
ASA IV	A patient with severe systemic disease that is a constant threat to life	E.g.: Ongoing cardiac ischemia or severe valve dysfunction, Recent (<3 months) MI, sepsis,
ASA V	A moribund patient who is not expected to survive without the operation	E.g. Ruptured abdominal/thoracic aneurysm, massive trauma, Intracranial bleed, multiple organ/system dysfunction
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

Development of Endodontic Treatment Plan

- Strategic value of a tooth
- Decisions: Straightforward/ Challenging
- Decision: Endodontic therapy, or extraction and implant placement
- Preservation of natural dentition
- Endodontic treatment: Poor prognosis - extraction and implant placement

ENDODONTIC PROGNOSIS

- Success rates > 90%
- High overall success rate – different from the prognosis
- Ideal Root Canal Treatment – excellent prognosis
- Inadequate Endodontic treatment standards – markedly reduced prognosis

Messer HH. Clinical judgement and decision making in endodontics. Aust Endod J. 1999 Dec;25(3):124-32.

1. **Endodontic Factors:**

- Presence or Absence of Periapical Radiolucency
- Technical standards of treatment
- Calcified Canals
- Procedural Problems

2. **Non-Endodontic Factors:**

- Final Restoration
- Periodontal Condition

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Endodontic Situation	Success
Teeth without periapical lesions	96-100%
Teeth with periapical lesions - overall	82%
• Meets technical standards of ideal treatment	94%
• Inadequate technical standard	68-76%
• Calcified canals	60-70%
• Procedural problems	Varied down to 50% or less
Restoration (posterior teeth)	
• Full occlusal coverage	90-95%
• No occlusal coverage	50-60%
Periodontal problems	Prognosis dictated by periodontal condition

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Endodontic Retreatment

- Mann V. et al., 2008 – outcome of retreatment cases similar to treatment cases

- Incidence of postoperative pain and flare up – higher in retreatment cases

- Factors Affecting Retreatment

1. Preoperative periapical lesion
2. Apical extent of root filling
3. Quality of coronal restoration

- Retreatment plan: developed after determination of the cause of failure

- Surgical endodontics combined with nonsurgical retreatment

Evaluation of Endodontic Treatment Outcome

- Periodic follow-up examinations
- Important in teeth with apical periodontitis
- **Healing of apical lesions:** Months or years
- Periodic review – Determination of course of healing
- **Ideal outcome:** Absence of clinical signs/symptoms and complete radiographic healing

European Society of Endodontology Guidelines,

- 1st follow-up examination – 1 year

- Original lesion – only diminished – categorized as “questionable” and followed for up to 4 years

- Treatment plan modified – clinical symptoms develop/ lesion increases in size

Single-Visit Versus Multiple-Visit Treatment

- Debate concerning **single visit endodontics**
- Some clinicians – treat all cases in a single visit
- Others believe – vital cases are suitable for single-visit treatment
- Severity of the patient's symptoms
- Necrotic pulp, severe pain, with or without swelling: single visit therapy not considered
- Treatment – directed at alleviating pain

Indications:

- Vital teeth
- Factured anteriors where aesthetics is the concern
- Teeth with accidental pulp exposure
- Medically compromised patients who require antibiotic prophylaxis
- Physically compromised patients

Parameters	Single Visit VS Multiple Visits Findings
Post-treatment pain	Less in Single Visit (Fava LR, 1991) Similar in both (Figini L. et al., 2008)
Healing Rate	Similar (Figini L. et al., 2008)
Radiographic Success	Similar (Su Y. et al., 2011)

Periodontal Considerations

- Severe periodontal lesions – complicate endodontic prognosis
- Periodontal factors influencing endodontic prognosis

1. Root perforations
2. Bone loss
3. Clinical attachment loss

- Treatment Plan for Endodontic/ Periodontal Lesion

- **Primary endodontic disease**, the pulp is nonvital - treated solely by endodontic therapy – prognosis is usually favorable

- **Primary periodontal disease** the pulp retains vitality – treated only by periodontal therapy – prognosis – variable

- **True combined endodontic–periodontal disease** occurs less frequently – requires both endodontic and periodontal therapy – prognosis: questionable

Surgical Considerations

- Endodontic surgery performed – to improve the apical seal
- Primary cause of failure: Microbial leakage – inadequate apical seal
- Determination of the cause of microbial leakage
- Treatment plan

- Periodontal condition – significantly affect long-term prognosis of periapical surgery
- Kim E. et al.,2008 reported

Lesions	Success Rates in periapical surgery
Endodontic lesions	95.2%
Endodontic– periodontal combined lesions	77.5%

Restorative and Prosthodontic Considerations

- Factors affecting Final outcome:

1. Subosseous root caries
2. Poor crown-to-root ratio
3. Extensive periodontal defects
4. Mal-alignment of teeth

- Full-coverage restoration – endodontic access – difficult

- Gillen BM. et al., 2011 – found – chances for healing increase with **both adequate root canal treatment and adequate restorative treatment**

- **Poorer clinical outcomes** – expected with adequate root filling/inadequate coronal restoration and inadequate root filling/adequate coronal restoration

- Quality of the coronal restoration as important as the quality of the root canal treatment

Endodontic Case Difficulty Assessment Form

- The AAE designed the Endodontic Case Difficulty Assessment Form for students to help with case selection and documentation of cases

- Referring dentists may also use the Assessment Form to help with referral decision making and record keeping

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Endodontic Case Difficulty Assessment Form

See other side for directions

Patient Information

Name _____

Address _____

City/State/Zip _____

Phone _____

Patient Considerations

Medical History	
	cardiovascular diseases
	cerebral vascular considerations
	bleeding disorders
	renal dysfunction
	medical prostheses
	abnormalities in host defense
	diabetes
	mental impairment
	acute systemic disease
	pregnancy
	need for pre-medications
	other systemic conditions

Local Anesthetic Considerations

Objective Clinical Findings

Diagnosis	
	inconclusive or contradictory findings

Radiographic Findings	
	difficulty in obtaining films of diagnostic value

Pulpal Space	
	calcification
	chamber
	orifice
	canal
	number of canals

Additional Conditions

Restorability	
	isolation challenge
	caries
	need for crown lengthening

Existing Restoration	
	porcelain crown
	PBM/PFM
	gold castings
	impaired access to root canal
	abutment
	long axis of crown vs. long axis of root
	size of crown
	crown anatomy vs. original anatomy
	post and core (Rate 2 or 3 only)

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Local Anesthetic Considerations	
	vasoconstrictor contraindication
	anesthetic allergy
	history of difficulty in obtaining profound anesthesia

Personal Factors and General Considerations	
	limited ability to open mouth
	gagger
	fear of dentistry
	motivation to preserve dentition
	physical impairment–difficulty holding film
	limitation to be reclined
	size of mouth

Root Morphology	
	curvature
	dilaceration
	long
	recurvature
	length
	long
	short

Apical Morphology	
	open

Malpositioned Teeth	
	buccal version
	rotated or tipped
	too far distally

	post and core (Rate 2 or 3 only)

Fractured Tooth	
	crown
	root

Resorptions	
	internal
	external
	apical

Endo-Perio Lesion	
	tooth mobility
	attached gingiva minimal/inadequate
	furcation involved
	periodontal prognosis
	root section or hemisection consideration

Trauma	
	avulsion
	luxation

Previous Endodontic Treatment	
	Rate 2 or 3 only

Perforations	
	Rate 3 only

Disposition

Treat in Office Yes ❒ No ❒

Refer patient to: _____

Date: _____

The American Association of Endodontists' Guidelines for Assessing the Difficulty of Endodontic Cases are designed to aid the practitioner in determining appropriate case disposition. The American Association of Endodontists neither expressly or implicitly warrants any positive results associated with the use of these Guidelines. These Guidelines may be reproduced but may not be amended or altered in any way.

Messer HH. Clinical judgement and decision making in endodontics. Aust Endod J. 1999 Dec;25(3):124-32.

Use of the Endodontic Case Difficulty Assessment Form

1 = Average Risk: Indicates average or routine complexity – Predictable treatment outcome – attainable by a competent practitioner

2 = High Risk: Complicated, presenting one or more treatment or patient impediment factors – challenging for a highly skilled practitioner

3 = Extreme Risk: Exceptionally complicated, presenting one or more difficult treatment or patient impediment factors – challenging for even the most highly skilled practitioner

Messer HH. Clinical judgement and decision making in endodontics. Aust Endod J. 1999 Dec;25(3):124-32.

Conclusion

- The clinical management of patients requiring endodontic treatment begins with an accurate diagnosis of the cause of the endodontic pathology
- The diagnostic process in endodontics may be challenging since numerous causes of orofacial pain exist and multiple tests are required to help identify endodontically related pain
- Thorough risk assessment will lead to a comprehensive and well conceived treatment plan
- If done thoroughly prior to commencement of endodontic treatment the chances of a successful outcome for the patient and practitioner are greatly enhanced

Thank You!

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