

# ***Geriatric Endodontics***

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# INTRODUCTION

- Aging population is a global phenomenon having profound implications on human life, society and economics.
- Estimates suggest that as many as 62% of people over age of 60 have at least one tooth with apical periodontitis of pulpal origin.
- As per the Population Census 2011, there are nearly 104 million elderly persons (aged 60 years or above) in the country; comprising of 53 million females and 51 million males.

- The term *geriatric* stems from a Greek word “*GERON*” meaning *old man* and “*IATROS*” meaning *healer*.
- It is cognate with “*JARA*” in Sanskrit which also means ‘*old*’.
- Three groups of older subjects are identified:
  1. Younger Older adults (65-69 yrs)
  2. Middle Older adults (70-79 yrs)
  3. Oldest Older adults (80 yr and above)

-(according to chronological age grouping)

*“Geriatric dentistry is the delivery of dental care to older adults involving diagnosis, prevention and treatment of problems associated with normal aging and age related diseases as part of an inter-disciplinary team with other health care professionals”.*





To lead a **quality life** in old age, one needs teeth not only for the **enjoyment of food** but also for **proper nutrition** and **pleasant looks**.



## Risk factors in old age patients:

- Old age is associated with several risk factors, both general as well as those specific to the oral cavity.
- The general risk factors include various medical problems, medication induced side effects and psychological problems.
- The risk factors related specifically to oral cavity are gingival recession, presence of restorations, and age related pulpo-dentin changes.

## Medical problems

- More than 50% of patients over 60 years of age are medically compromised and are on medication.
- Most commonly seen medical conditions are diabetes, hypertension, cardiovascular diseases, arthritis and neuromuscular problems like Parkinson's disease and Alzheimer's.
- The above clinical conditions can even trigger emergency situations during dental treatment if proper considerations and precautions are not taken.
- Therefore all health care providers should be familiar with the course and the complications associated with these disease conditions and the prophylactic guidelines provided for such medical conditions.

## Psychological factors

- Many elderly patients suffer from endogenous depression on account of loneliness or feeling of neglect.
- Senile dementia is a common phenomenon seen amongst the elderly that can cause memory loss, confusion, difficulty in making decisions, lack of comprehension and alter ability to learn new tasks associated with the treatment modality.
- Hearing and vision impairment can further worsen the situation.



## Dry mouth

- Saliva plays a major role in oral homeostasis and is very much necessary to prevent oral disease.
- Although there is some conclusive evidence with regards to salivary hypo function due to aging, it is not a simple sequel to growing old.
- It is usually associated with use of medications such as anti-depressants, anti-hypertensive, anti-cholinergic, anti-asthmatics, etc. commonly taken by the elderly.

# Age Changes in Dental Tissues

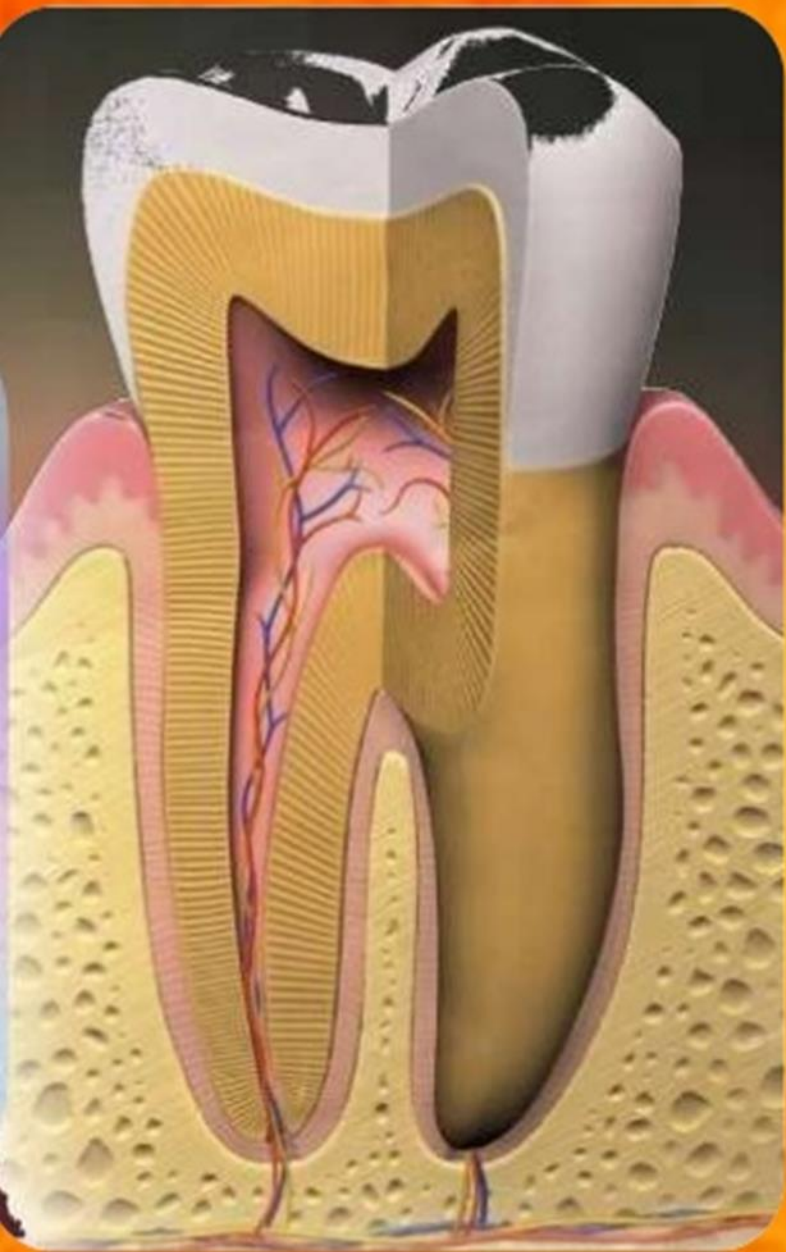
# Dentin

- Dentin consists of 47% hydroxyapatite, 30% organic matter, and 23% water.
- Dentin of older teeth contains less water than that of younger teeth and is more likely to have cracks develop within its structures.
- Calcifications or calcific metamorphosis in the pulp lumen can result from aging, caries, trauma, or dental treatment such as pulp capping.
- Certain medications, taken for systemic conditions, may cause dentin hyper-calcification and loss of vertical height of the pulp chamber.

## Comparison among the ages







Increased bulk of dentin and increased pulp fibrosis

may diminish the response to traditional vitality testing.

Hence, it will be wrong to assume that the pulp is non vital and carry out the treatment without other supporting evidences.

## Cementum

- Cementum thickness increases threefold between the ages of 10 and 75 years.
- Cementum width ranges from 100 microns to 200 microns in young teeth and from 400 microns to 500 microns in older teeth.
- This may affect correct assessment of working length as it can give a radiographic appearance of the working length being short.
- Electronic apex locators prove very beneficial in avoiding such errors.

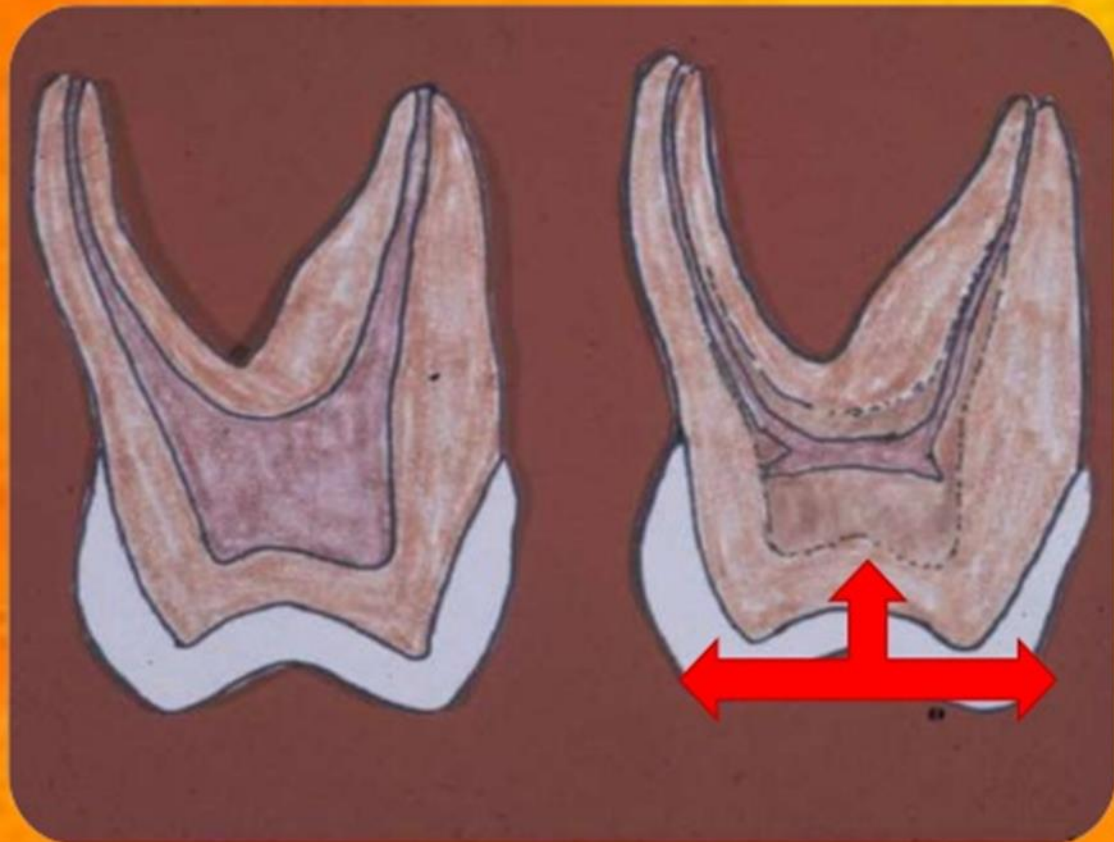
# Pulp

- With age, the volume of the pulp decreases and a reduction in the neurovascular components occurs.
- Odontoblastic activity and continued deposition of secondary and tertiary dentin occurs throughout life.
- A decrease in pulp cell density may reduce the reparative capacity of the pulp after restorative treatment.

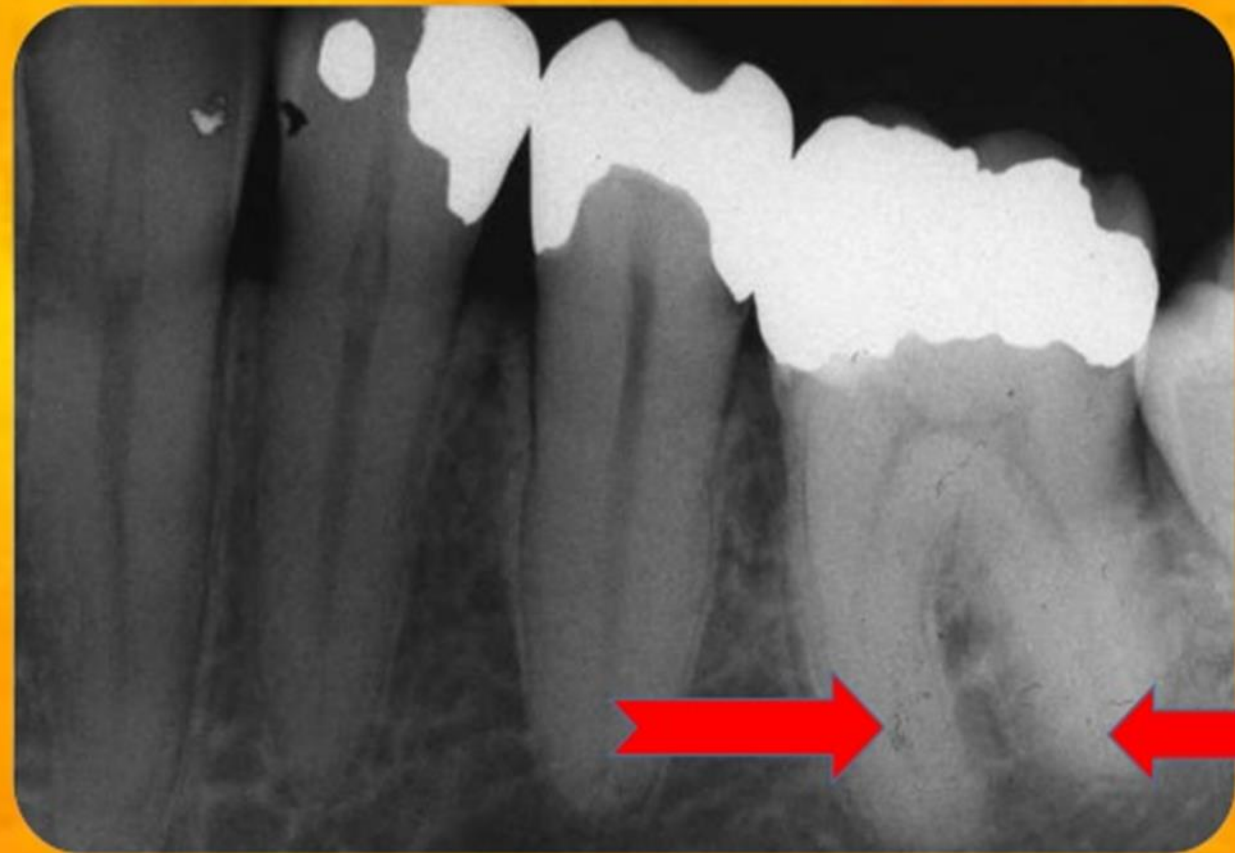
- Capillaries in the sub-odontoblastic layer decrease and there is a thinning of the odontoblast layer.
- Much like pulp vascularity, the number of pulpal neurons is reduced as an individual ages.
- Studies have found that the total number of myelinated fibers decreased with age. The decrease in A-delta fibers might be related to reduced sensitivity to perception of pain, as these fibers are fast conducting.



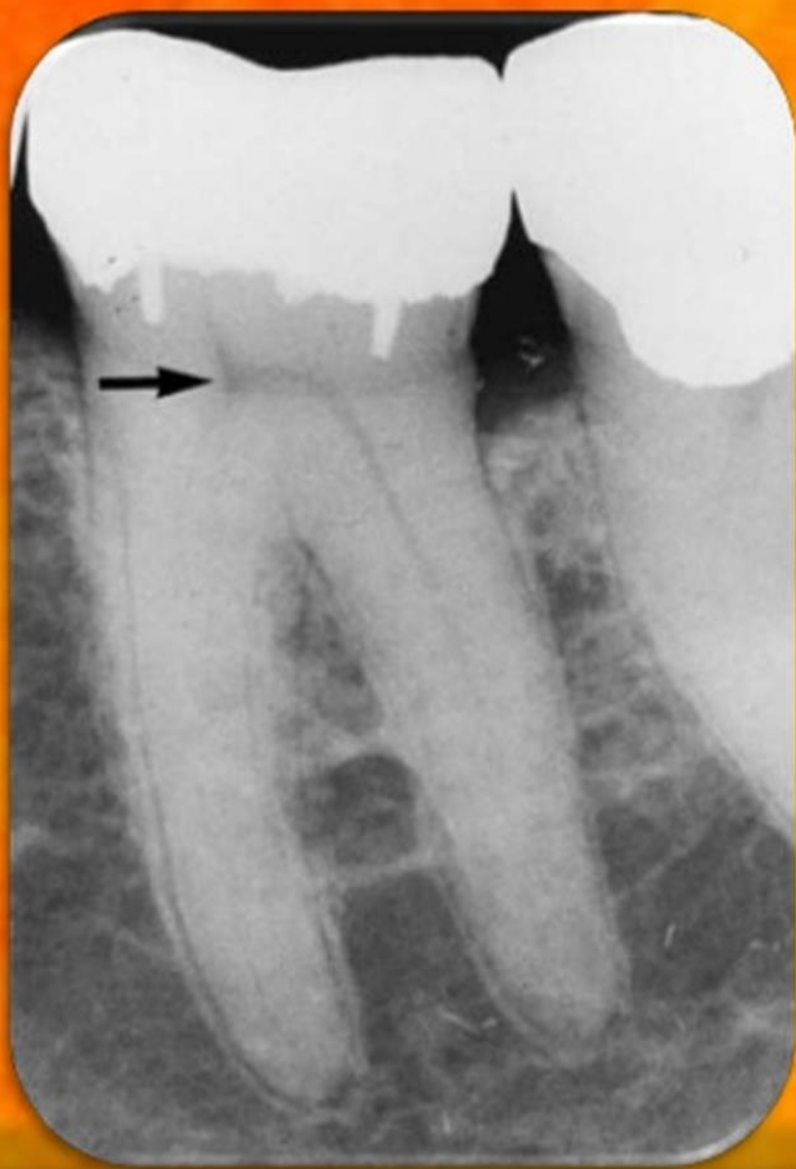
# PULP CHANGES WITH AGE



Continuing Dentin Formation



Calcifications increase



Young tooth

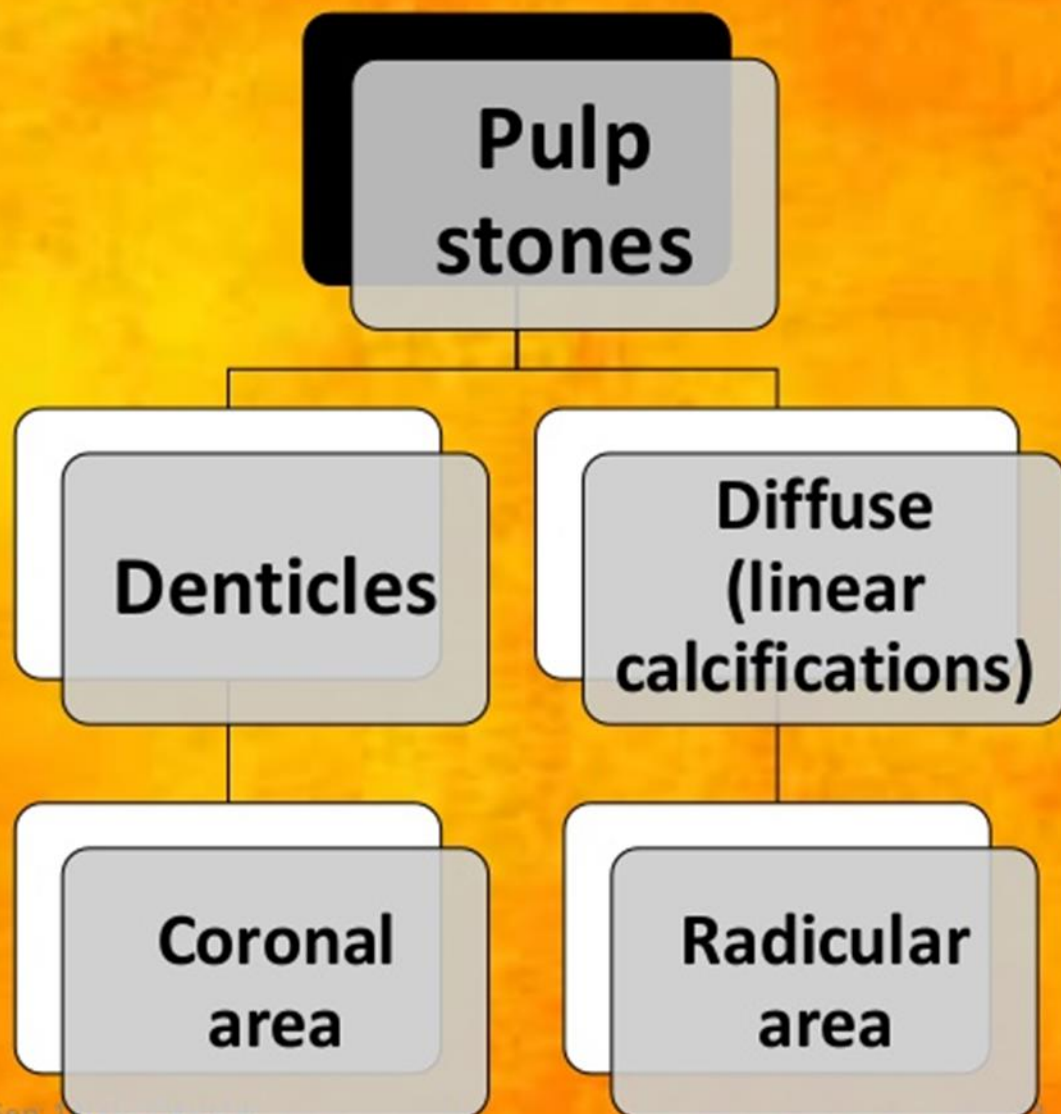
Old tooth

**reparative dentine formation, canal & Pulp space decreases in size**



# Pulpal calcifications

Pathologic process related to injury



# **Age Changes related to Oral Tissues**



## Periradicular Bone

- There is not sufficient data in the literature regarding unique age-related changes in periradicular bone and its response to endodontic treatment.
- In general, bone formation steadily declines with age leading to a significant reduction in bone mass.
- The alveolar bone has high plasticity and under physiological conditions, it is preserved by the equilibrium between osteoblastic and osteoclastic activity.

- The extracellular matrix surrounding osteoblasts has been shown to play an important role in bone metabolism. A possible dysfunction of this matrix might occur concomitantly with the aging process.
- Osteoporosis, a multifactorial metabolic disorder, is a major disorder afflicting men and women in old age.
- The most common structural changes are reduction in size and number of bony trabeculae and thinning of the cortical region, particularly in the anterior region of the maxilla and the posterior region of the mandible.

# Periodontal Ligament

- The fiber and cellular content of the periodontal ligament (PDL) decrease with age and its structure becomes more irregular.
- PDL cells of elderly individuals show lower rates of chemotaxy and proliferation than those of young individuals.
- Clinically, progressive changes in gingival tissue, due to recession, periodontal disease or periodontal treatment, may expose lateral or accessory canals, that may act as a portal of entry for microorganisms to the dental pulp.

# Salivary Glands

- There is a reduction in the volume of acini and an increase in ductal volume, fatty and fibrous tissues, and callus formation in the salivary gland.
- Xerostomia, hypo-salivary function or dry mouth is a frequent complaint of elderly individuals and it constitutes a major clinical problem.
- More than 25% of patients over 65years of age complains of xerostomia.



# Temporomandibular Joint

- Temporomandibular dysfunction (TMJD) caused by a compromised occlusion from multiple missing teeth, drifted teeth, bruxism, and loss of vertical dimension or arthritic disease may cause acute or chronic pain and affect the inter-incisal opening and duration of time the patient can keep the mouth open during endodontic treatment.
- This may affect the endodontic appointment duration and limit the access for endodontic instrumentation, especially in posterior teeth.

# CLINICAL CONSIDERATIONS

## Endodontic Treatment Outcomes

- Based on epidemiological studies there is no correlation between age and outcome of endodontic treatment.
- Endodontic treatment can be as predictable in the elderly patient as in younger patients.
- Also, studies have shown similar healing pattern of oral tissue in the young and the old, with a delay in healing response in older teeth.

- There are no medical contraindications to endodontic therapy in the elderly except for the American Society of Anesthesiologist (ASA) type IV or type V patient, needing urgent medical attention.
- Endodontic outcome studies have consistently shown a survival and retention rate higher than 90% in teeth treated with non-surgical root canal therapy.
- Therefore, when indicated, endodontic treatment is a good alternative to extraction and tooth replacement.
- The decision to perform endodontic treatment should be based upon medical health of the patient, prognosis, and cost-benefit of treatment.



## ASA Physical Status Classification

### Current Definitions and ASA-Approved Examples

ASA PS Classification	Definition	Adult Examples, Including, but not Limited to:
<b>ASA I</b>	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
<b>ASA II</b>	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity ( $30 < \text{BMI} < 40$ ), well-controlled DM/HTN, mild lung disease
<b>ASA III</b>	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity ( $\text{BMI} \geq 40$ ), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA $< 60$ weeks, history ( $> 3$ months) of MI, CVA, TIA, or CAD/stents.
<b>ASA IV</b>	A patient with severe systemic disease that is a constant threat to life	Examples include (but not limited to): recent ( $< 3$ months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis
<b>ASA V</b>	A moribund patient who is not expected to survive without the operation	Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
<b>ASA VI</b>	A declared brain-dead patient whose organs are being removed for donor purposes	

Source: <https://www.asahq.org>

## Accessibility to Care

- Elderly patients may need easy access to the dental office and operator.  
Some may use accessories such as a wheelchair or a motorized cart.
- Waiting rooms, operatories, and restrooms need to be handicap accessible.
- Elderly patients should be monitored by the office staff from the moment they enter the dental operator until discharge upon completion of the treatment.
- In tandem, as more elderly patients find it difficult to visit a dental office, dental care services at senior citizen community centers and mobile dental clinics should also be available.

## Appointment Time and Duration

- Appointments should be scheduled according to the patient's preference (mostly early in the morning).
- Appointments should preferably be of short duration based on the patient's physical and medical conditions.
- Also, whenever possible and indicated, the number of treatment visits should be reduced since many elderly patients rely on being accompanied by others during dental visits.

## Medical History

- Due to visual, auditory, and cognitive impairment, the **Health Insurance Portability and Accountability Act (HIPAA)** of 1996 mandates a family, friend or caregiver may need to assist in completing the medical and dental history and in describing the chief complaint.
- The clinician should thoroughly review the medical history, need for medical consultation, premedication, and drug interactions before initiating any dental treatment.



## Dental History

- Details of dental history of aging patients are rarely complete and may show treatment by several dentists at different locations.
- The clinician should make all attempts to research and review old dental records and gather as much information as possible.
- The number of times the tooth has been restored, the addition of restorative surfaces on a tooth over time, history of falls, and surgery under general anesthesia may be pertinent to the diagnosis.

## Diagnostic Tests

- The positioning of intraoral radiographic films and inflexible digital sensors may be difficult due to decrease in muscle tonicity, limited intra-oral opening, and presence of exostoses.
- Use of soft foam padding around the edges of the digital sensor or smaller pediatric sensors should be considered.
- Sometimes, if the tooth undergoing endodontic treatment is heavily restored and calcified, a periapical radiograph of the contralateral tooth may be beneficial in determining the anatomy of the root canal system.

- The clinician can also assess previous radiographs if available, to determine position and deposition of tertiary dentin over time.
- Often it may be prudent to obtain prior permission from the patient and referring dentist to remove a prosthetic crown if access becomes difficult.
- The clinician may consider and prescribe a CBCT analysis in severe cases of calcification and retreatment after determining the benefit to risk ratio to the patient.

## Patient Positioning and Comfort

- Elderly patients may require special positioning during treatment.
- They should be seated comfortably in the dental chair equipped with an adjustable headrest and pillows.
- Some patients may have difficulty reclining in an extreme supine position due to conditions such as osteoarthritis or neck and back problems.
- At the end of the endodontic procedure bring back the patient from supine position in a gradual manner in order to avoid orthostatic hypotension.



- Bite blocks should be used to stabilize the jaw especially in patients with conditions affecting muscle tonicity such as Parkinson's disease or dystonia.
- Bright operatory and surgical operating microscope lights may be shielded from the elderly patient's eyes by using dark glasses.
- Also, blankets may be necessary if the temperature in the operatory is too low for the patient.
- Prior to discharging the patient, allow them time to recover both mentally and physically. Verbal and written instructions should be given to the patient and to the accompanying individual.

# Anesthesia

- Older patients tend to be less anxious, have a higher threshold of pain tolerance, and are more likely to prefer less anesthetic, especially if the tooth is asymptomatic.
- There are no contraindications to use vasoconstrictors in dental local anesthetics in routine endodontic procedures in elderly patients.
- Supplemental anesthesia such as intra-osseous or intraligamentary injections should only be administered as the last option.

## Tooth Isolation

- All root caries and defective restorations should be removed to evaluate tooth restorability and to determine if the tooth is salvageable.
- Placing a clamp may be challenging in patients with decreased muscle tonicity, or with limited oral opening.
- Often the dental dam may need to be placed after access and location of canal orifices.
- Avoid clamping teeth that appear weak from extensive caries or restorations especially in the anterior dentition.

- Elderly patients may need to be given frequent breaks during the appointment to facilitate breathing or use of restroom.
- The dental dam may need to be taken off during this time.
- The tooth should ideally be temporized with cotton and temporary restorative material during this phase.



## Access Cavity

- Enhanced illumination and magnification will greatly enhance visibility and aid in access.
- The clinician needs to be aware, that due to modified patient positioning in the dental chair, the orientation of the crown or the root may change during visualization and access.
- “Walking” a periodontal probe along the cemento-enamel junction (CEJ) and using the “Laws of Access Preparation.” will provide a systematic approach to locating root canal orifices.

- Initial access into a calcified pulp chamber may be gained without a dental dam to aid in visualization of the pulp chamber and to avoid iatrogenic procedural errors.
- Orientation should be verified and confirmed visually and radiographically. The traditional “drop into the pulp chamber” may not be felt, making careful exploration with an endodontic explorer and the measurements from occlusal surface to the roof of the pulp chamber more relevant.

# Access opening



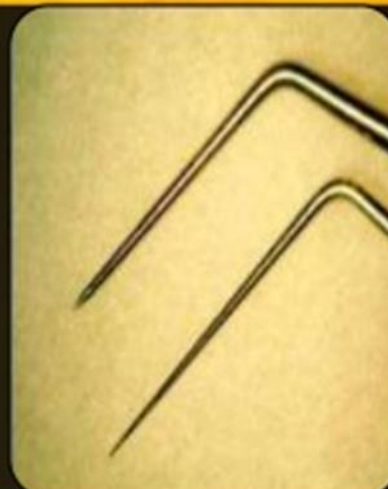
**Endo  
Access  
bur**



**Endo Z  
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**C Plus  
files**



**DG 16  
explorer**



**Flaring**  
should be  
performed  
to provide  
for a  
reservoir of  
irrigation



Very few  
canals have  
adequate  
diameter to  
allow the  
safe &  
effective use  
of broaches



The pulp stones can be visualized often with additional light and **magnification.**



**Ultrasonic troughing tips** are especially useful in cutting through the calcifications that covers the canal orifices.



## Canal Length Determination

- As described earlier, age-related cementum thickening may alter the original locations of apical foramen.
- Electronic apex locator readings, together with good radiographic assessment, tactile sensation, and wet-dry paper point test to determine the working length, are important.
- Patency may not be achievable in all cases

## WORKING LENGTH



An in vitro study indicates these are safe to use with pacemakers

## Cleaning and Shaping

- There are no specific considerations for cleaning and shaping procedures in the elderly patient.
- After establishing a glide-path and working length, the cleaning and shaping can be completed using standard protocol.
- It should be noted that the root canal lumen is expected to be smaller and the dentin tissue more sclerotic. Copious use of chelating agent such as Ethylene Diamine Tetra Acetic acid (EDTA) in negotiation and establishing a glide path may be helpful.

- Frequent irrigation with sodium hypochlorite will help soften and dissolve the fibrous pulp tissue greatly facilitating the shaping and cleaning procedure.

# Obturation

- No special treatment modifications are needed for cold or warm obturation techniques.
- When using the down-pack and backfill for the warm vertical obturation techniques, the clinician should be conscious of the fact that the elderly patient may not have an adequate intra-oral opening and may move during the procedure.
- Sometimes a different obturation system such as carrier-based or a single cone technique may have to be considered as an alternative.



# OBTURATION



Selects Gutta-Percha filling techniques that **do not** require unusually **large mid-root tapers** and do not generate pressure in this area, which could result in **root fracture.**

# Tooth Restoration

- Elderly patients may present with teeth that have had multiple restorations or insults over time.
- At this point, these teeth often need extensive restorations such as full coverage or onlays.
- It is essential to place a coronal seal immediately after root canal therapy to prevent failure of treatment due to coronal leakage,
- Ease of application and potential fluoride releasing properties of glass-ionomer or glass-ionomer resin-modified restorative materials makes them preferable over the more technique-sensitive composite restorations.

## Retreatment

- With age, the incidence of endodontic retreatments may increase, due to coronal leakage from loss of seal, recurrent caries or fracture of teeth, and restorations.
- Also, overlooked or missed canals are a more common cause of failure in older patients.
- An isolated symptom, heat sensitivity is usually indicative of a missed canal. Retreatment indications and considerations are the same as in younger patients.

## Apical Surgery

- Often, with age, the position of anatomic structures such as the maxillary sinus, the inferior alveolar nerve canal, mental foramen, and incisive foramen may change as a result of multiple missing teeth and residual ridge resorption over time.
- The changes in position of these anatomical entities should be observed and considered during the treatment planning.
- Elderly patients may be taking prescription anticoagulants or self-prescribed low-dose aspirin.

- Studies have shown that anti-coagulant therapy should preferably not be stopped and hemorrhage during endodontic surgery should be controlled by local hemostatic agents.
- Post-operatively, patients must be informed about the possibility of ecchymosis. This sub-epithelial hemorrhaging presents itself as purple-red discoloration and is self-limiting. Tissues regain normal color in few weeks.
- Sometimes, due to periodontal disease, root resorption or crown attrition, periodontal and endodontic surgery may need to be combined to get adequate crown root ratio and tissue attachment.



# ENDODONTIC SURGERY:

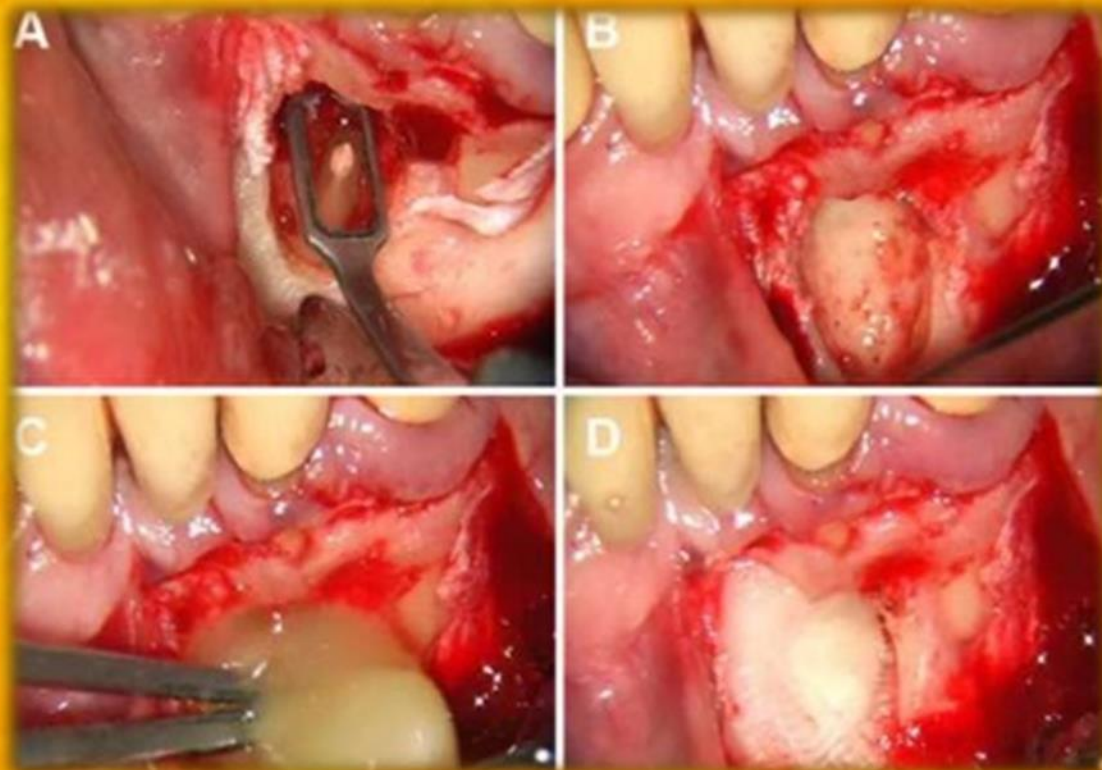
The need for establishment of drainage and relief of pain are not common indications for surgery

**Less traumatic** than an extraction

**Tissue is less resilient** and resistance to reflection appears to be diminished.

Lips can more easily be stretched; the **apex can actually be more surgically accessible** in older patients

**Ecchymosis** is a more common postoperative finding,



## CONCLUSION

- Root canal treatment in elderly patients has a significant role in comprehensive dental care due to the increased presence of an “aging society.”
- As the population ages, elderly patients become a more heterogeneous social and economic group.
- Cognitive status, multiple chronic diseases, and medications add to the heterogeneity of this population.

- Consequently, physical, emotional, and psychological conditions of the elderly patient must be considered for proper and successful oral healthcare, including endodontic therapy
- It is thus important to provide a practical evidence-based endodontic approach that enables appropriate patient management and maintains and/or improves oral health as part of total healthcare services.



*“He, who is born, has to go through childhood, youth and old age. If aging is inevitable, let's be graceful and serene about it and lead a disciplined quality life.”*

• – **Bhagvad Gita.**