

REVIEW ARTICLE

Geriatric Endodontic

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ABSTRACT

Developments in medicine have resulted in an increase in the life span of people, thereby leading to an increase in the number of geriatric patients. Adverse oral health has been identified as a risk factor for several systemic disorders/diseases. Therefore, dental care should be integrated into overall health management of all geriatric patients. Increased numbers of such patients in dentistry has resulted in the preferred use of alternatives like endodontics rather than extractions to improve the longevity of the natural dentition. Special knowledge, skills and attitude are necessary for the management of the geriatric patients. This review discusses the unique challenges faced by the endodontist in carrying out root canal treatment in such individuals.

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INTRODUCTION

Geriatrics is the branch of medicine that focuses on health promotion, prevention and treatment of disease and disability in later life.

The term itself can be distinguished from gerontology, which is the study of the aging process itself. The term comes from the Greek geron meaning 'old man' and iatros meaning 'healer' and was proposed in 1909 by Dr Ignatz Leo Nascher. Geriatric dentistry is the branch of dentistry that emphasizes dental care for the elderly population and focuses upon patients with chronic physiological, physical and/or psychological changes or morbid conditions/diseases. Management of the geriatric patient requires special considerations for age-related physiological changes, complications of chronic conditions, increased incidence of physical or mental disabilities, support systems and financial limitations. Therefore, a multidisciplinary approach is advised consisting of all dental specialties, experts in geriatrics, psychiatry and social services with their rehabilitation team. Multipharmacy, physical impairment and neurological/psychological changes are common among the elderly, resulting in drug-associated oral diseases or conditions (e.g. dry mouth, gingival hyperplasia and lichenoid reaction) and poor oral hygiene due to physical disability and neglect.¹

In-depth theoretical knowledge, clinical skills, and behavioral management are the keys to successful management of care seekers, especially the elderly patients.²

Chronological age refers to age as measured by calendar time since birth, while functional age or physiological age is based on performance capacities.

Gerontologists have divided the study of the older population into several categories based on chronological age:

- New-old (55-64 years)
- Young-old (65-74 years)
- Middle-old (75-84 years)
- Old-old (85-plus years)

Functional ability should be the standard that differentiates an individual's capability to maintain activity.

Pathologic and Physiologic Changes in Geriatric Patients³

Cardiovascular System

- Coronary artery disease—angina pectoris, arrhythmias, myocardial infarction, decreased contractility
- High blood pressure—cardiac disease, cerebrovascular disease, renovascular disease.

Central Nervous System

- Alzheimerism
- Cerebral arteriosclerosis—CVA, decreased memory, emotional changes
- Parkinsonism
- Responses to stimuli—all autonomic reflexes are slower
- Sleep patterns—less restful sleep, possible insomnia
- Voice: decreased range, may become higher pitched.

Endocrine System

- Decreased response to stress
- Maturity—type two adult-onset diabetes mellitus.

Gastrointestinal System

- Mastication—impaired, due to loss of teeth or ill-fitting appliances
- Swallowing—more difficult as salivary secretions decrease
- Digestion—decreased due to reduction in production of digestive enzymes.

Genitourinary System

- Decreased renal blood flow
- Decreased number of functioning glomeruli

- Decreased tubular reabsorption
- Benign prostatic hypertrophy
- Increased urination frequency
- Incontinence.

Hearing

- Decrease in hearing capacity, may wear hearing aids
- Integumentary system
- Texture—skin loses elasticity, wrinkling, dryness
- Color—face paler, spotty pigmentation
- Temperature—extremities cooler, decreased perspiration
- Hair—decreased growth, thinning, graying
- Nails—decreased growth, increased ridges.

Olfactory System

Decrease in sense of smell (will affect the sense of taste).

Oral Cavity

- Bone—darker in color, stained, attrition, weakened under load
- Circumoral tissues—stiffen
- TMJ—muscle tone decreases
- Mucous membranes—dry, shiny, more fragile
- Periodontium—recession, redness, swelling, deterioration of bone
- Tongue—increase in the number of lingual varicosities
- Salivary glands—decreased production, especially by some medications.

Respiratory System

- Arthritic changes in thorax
- Interstitial fibrosis
- Pulmonary problems related to pollutants
- Senile emphysema
- Anatomic structure-increased anterior-posterior diameter.

Vision

- Decrease in peripheral vision
- Sensitivities to bright lights
- Glaucoma
- Cataracts.

Geriatric endodontics is mainly about the effect of aging on diagnosis of pulpal and periapical disease and successful root canal therapy.⁴

CHANGES WITH AGE¹

Saliva

One profound side effect of multipharmacy is xerostomia (mouth dryness). Saliva is the primary oral defense

mechanism in maintaining tooth structure against oral infections. Saliva contains multiple antimicrobial factors, buffering systems, supersaturated calcium phosphates, large lubricant molecules and digestive enzymes. Salivary hypofunction usually causes rampant and severe oral diseases such as caries and Candida infection. Without adequate salivary function, quality of life also is likely to be compromised since salivary moisture offers lubrication for taste, speech, chewing and swallowing.

Effect of Drugs

Certain medications commonly prescribed for the elderly can cause enlargement of gingival tissues (e.g. phenytoin sodium and calcium channel blockers) or induce lichenoid reaction (e.g. hydrochlorothiazides and ACE inhibitors or angiotensin II receptor antagonists). Clinical conditions, such as hypertension, anticoagulation therapy and hypoglycemia, can trigger emergency crises during dental treatment. Patients with diabetes often have cardiovascular diseases and are more susceptible to infection if the disease is not properly controlled.

Although controversial, antibiotic prophylaxis may be necessary for dental procedures in frail elders to prevent infection of replaced joints and cardiac prosthetic valves. While dental health care workers provide their professional judgment regarding these special conditions, consultations with other health professions are often required to optimize patient care.

Aging of the Dental Tissues⁵⁻¹¹

Enamel

The enamel of our teeth endures both chemical and morphological changes through the years. These tissues become less hydrated and experiences superficial increases in fluoride content with age, especially with the uses of dentifrice and tap water. Thickness of the enamel does change overtime, especially on the facial, proximal contacts, and incisal and occlusal surfaces due to the many chewing cycles and cleaning with abrasive dentifrices. The disappearance of the outer layer of enamel overtime changes the way in which the tissue interacts with acidic solutions.

Dentin

The volume of dentin increases through the continuous apposition of secondary dentin on the walls of the pulpal chamber. Aged dentin is more brittle, less soluble, less permeable, and darker than it was earlier in life. There is formation of tertiary dentin in response to trauma, caries or any irritation. Thus the dentinal changes are:

- Increased peritubular dentin
- Increased dentinal sclerosis
- Increased number of dead tracts
- Decreased tubular permeability
- Increased reparative and secondary dentin formation
- Yellowish discoloration of dentin.

Pulp Space

The size of the pulp chamber and volume of the pulpal tissue decreases with reparative and secondary dentin formation. The odontoblastic layer surrounding the pulp changes progressively from a multilayer organization of active columnar cells to a single layer of relatively inactive cuboidal cells. Calcification of the root canals increases with age, and the cementum volume within the alveolus increases gradually overtime, notably in the apical and periapical areas.

Age changes in the Pulp

- Decreased cells
- Increased collagen fibers (fibrosis)
- Receding pulp horns
- Small volume of pulp space
- Calcifications
- Decrease in pulpal nerves and blood vessels
- Decreased pulpal healing capacity
- Decrease in odontoblastic size
- Disappearance of odontoblasts in pulpal floor areas especially in bifurcation and trifurcation.

In Root¹²

- Increased cementum deposition at root apex
- Calcification of root canals.

MEDICAL HISTORY⁴

A thorough medical history is more important in these patients because they are likely to suffer from chronic diseases and take more medications. Sensitivity to medications, drug intolerance and potential interactions with drugs prescribed for dental treatment are to be anticipated.

CHIEF COMPLAINT

- These patients usually have fewer complaints and dental pain usually is indicative of either pulpal or periodontal pain
- Patients must be allowed to explain in their own words at which time one must note for visual /auditory handicaps, patient's dental knowledge and his/her ability to communicate.

DENTAL HISTORY

Usually will have a history of repeated episodes of dental treatment and decay, multiple restorations and frequent dental visits.

SUBJECTIVE SYMPTOMS

Pulpal symptoms are usually chronic in these patients. If pain cannot be localized, one must rule out other sources of orofacial pain.

Objective Signs

1. Increased incidence of root sensitivity that is hard to control.
2. Increased incidence of caries specially subgingival root caries which is difficult to restore in the interproximal regions resulting in restoration failure and continued decay.
3. Tooth wear in the form of attrition, abrasion and erosion.
4. Increased susceptibility to cracks, cuspal fracture, craze lines due to loss of resiliency and decreased organic component of teeth.
5. Temporomandibular joint dysfunction and decreased vertical dimension owing to compensating bite because of loss of teeth.
6. Less tilting and supraeruption because of decreased eruptive forces of teeth.
7. Increased incidence of periodontal problems and a need for combined endodontic-periodontic treatment.

Diagnostic Aids^{8-11,13}

Pulp Testing

- Slow and gentle testing to be done
- Response to pulpal stimuli is weaker
- There is no correlation between the degree of response to electric pulp test and degree of inflammation because of decreased neural and vascular components, increased fibrosis, reduced pulp volume, change in character of ground substance, excessive calcification, pulp recession and extensive restorations.
- Must be avoided in patients with pacemakers
- Test cavity is less useful.

Radiographs

Film placement:

- Adversely affected by tori, exostoses
- Assisted by apical position of muscle attachments that increase depth of vestibule
- Use of film holders

- Increased exposure time due to tori, exostoses and denser bone.

Radiographic images generally show:

- Pulp calcifications
- Pulp recession
- Increased cementum formation at apex (hypercementosis)
- Small canals
- Even canal calcification throughout
- Decreased osteosclerosis and condensing osteitis
- Increased incidence of some odontogenic cysts and tumors.

DIAGNOSIS AND TREATMENT PLAN ^{3,4,14-16}

General Considerations

- Patients can be reassured by providing information about the treatment, allowing time for questions, not rushing to begin treatment, and paying attention to the individual's needs and feelings while providing an environment conducive to communication, understanding and patient education
- Must obtain prior informed consent
- Preferably schedule morning appointments for treatment procedures
- Three tips for calming an anxious patient include remaining calm, reassuring the patient continuously, and making sure the anesthetic is effective when being used.

Improving Patient Comfort

Aging patients may have impaired physical mobility or sensory perception. Breathing patterns may be irregular, causing the patient to become easily winded. Escorting the patient slowly down the hall, matching their gait, and offering an arm for them to grab onto will help make the patient feel a bit more relaxed. For those traveling by a walker, walk ahead of the patient slowly. For those traveling by wheelchair, slowly push the chair to the treatment room and, depending upon the dental chair position, either back into the room or go forward through the doorway. Line the wheelchair up with the dental chair for easier transfer of the patient. Some older adults find it difficult to sit for extended periods in the dental chair, or may object to being placed in a supine position, while others have difficulties with support and balance. Most patients can be treated successfully within the dental office with a few adaptations. Ideally, patients should be treated in the dental chair, but occasionally a patient in a wheelchair may be unable to transfer to the dental chair. In this case, the dental team can move the wheelchair as close to the dental unit as possible, and work standing up. For those patients treated in the dental chair:

- Dental office should be designed to accommodate people with special needs (e.g. wheelchairs). Patients who remain in the wheelchair during treatment will need additional head support in the form of a portable headrest
- Timing of appointment should be either early morning or late morning/afternoon so that the patient would have had his/her breakfast and routine medications
- Chair adjustments (preferably upright position) and pillows are required for neck support. Always ask the patient before moving the chair or adjusting supports, and frequently ask if the patient is still comfortable
- Shield patients eye from dental light
- Prevent jaw fatigue by short treatment procedures and the use of bite blocks
- Restroom facility is necessary for breaks at regular intervals
- Need for anesthesia depends on:
 - Pulp vitality status
 - Cervical positioning of rubber dam clamp
- During anesthesia
 - Anatomic landmarks more prominent
 - Anesthetics to be deposited more slowly
 - Intraligamentary injection difficult because of decreased width of periodontal ligament space
 - During intraosseous anesthesia
 - Use smaller amounts of solution
 - Use 3% mepivacaine instead of 2% lidocaine
 - Intrapulpal anesthesia is difficult due to decrease volume of pulp
- Isolation should be carried out for single tooth preferably
- Multiple tooth isolation should be carried out only if adjacent teeth can be clamped and saliva ejector placement tolerated (Saliva ejector is usually not preferred because of decreased salivary outflow and gag reflex).

Orthostatic Hypotension

Care must be taken at the completion of the appointment so the patient is not brought to a different position abruptly. Orthostatic hypotension is a frequent occurrence in the older adult with quick positional changes. Allowing the patient to sit for a minute or two before escorting the patient to the reception area helps them regain their balance.

Access

- Identification of canal orifices and access to root canals can be challenging therefore, use of magnification (microscopes) is an advantage
- Use of DG 16, micro-openers and microdebriders to locate canal orifices. Piezo electric ultrasonic endodontic

tips are excellent for removing the secondary dentin that often covers the canal orifices

- Another aid in the treatment of geriatric patients is the use of transillumination. The technique is quite simple. Turn off all the lights in the treatment room and turn off the light on the dental unit. Proceed to shine the fiber optic light through the tooth at the CEJ level. The tooth will appear like a 'Jack O' Lantern'. Calcified canals will appear as dark dots, not as wide canals. Transillumination is also a good way to diagnose cracked and fractured teeth
- Negotiation with No. 8/No.10 K-file with chelating agents
- Use of dye to differentiate orifice surrounding dentin
- Avoid use of broaches
- Modification to enhance access-Coronal tooth structure might have to be sacrificed for access (at times even complete removal of crown) and widening of axial walls for visibility
- Perforations are more likely to occur as the pulp chamber is calcified and disk- like. Immediate sealing with an appropriate root repair material improves the prognosis significantly.

Preparation

- Calcification of older canals is much more concentric and linear and this allows easier penetration once canals are found
- Flaring of canal is advised early in the procedure to provide reservoir for irrigation solution and to reduce binding of instruments
- NiTi rotary instrumentation provides a more efficient and reliable shaping of the calcified and curved root canals and the clinician can bypass the tedious work of hand instrumentation benefit from the super elasticity of the NiTi metal
- Longer canals seen because of increased cementum deposition
- Use of instruments with no rake angle and crown down technique preferred
- The root canals associated with the elderly can be sufficiently cleaned and shaped if one can take the preparation to a fully tapered 0.04 taper
- Difficulty of locating apical constriction:
 - 0.5 to 2.5 mm from radiographic apex
 - Clinicians tactile sense reduced
 - Reduced periapical sensitivity in older patients
 - Use of electronic apex locator limited in heavily restored teeth
 - Penetration into calcified canal is difficult.

Obturation

- Gutta-percha techniques that do not require large midroot taper are preferred. A hydraulic/lateral condensation technique with a bioceramic sealer and coated cones is ideal and less time-consuming. Root fractures may occur when much taper is given to the canals and post failures are likely to occur with parallel posts
- Adequate coronal seal is mandatory and amalgam or bonded restorative materials may be used.

Success and Failure of Endodontic Treatment

- With vital pulps, repair of periapical tissues is determined by the same local and systemic factors as for the younger patient
- With nonvital pulps and periapical pathology repair is slow because of arteriosclerotic changes of blood vessels and altered viscosity of connective tissues. Periapical repair more difficult and the rate of bone formation decreases with age
- Periapical tissues need at least 2 years for healing
- Overlooked canals are a common cause for failure.

Endodontic Surgery

- Indications for endodontic surgery are not affected by age
- Medical considerations are definitely very important
- Local anatomic considerations in the elderly:
 - Increased incidence of fenestrated/ dehiscent root/exostoses
 - Soft and bony tissue thickness decreased
 - Apically positioned muscle attachments
 - Tissue less resilient
 - Resistance to reflection decreased
 - Surgically more access to apex in older patients
 - Root end filling important - chances of missed canal
 - Ecchymosis and delayed healing are common postoperative findings.

CONCLUSION

The needs, expectations, desires, and demands of older people may exceed those of any age group, and the gratitude shown by older adult patients is among the most satisfying of professional experiences. While it is surely wonderful that more geriatric patients are actively seeking dental treatment, it is also true that endodontic treatment for these patients is far more challenging and the conscientious endodontist will be prepared to meet the challenge. The need of the hour is to keep this age group in

mind while formulating dental education programs which can provide advanced training in geriatric dentistry and increase awareness through improved curriculum, research and publications on aging.

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