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Endodontic consideration in geriatric patients

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Abstract

Advancements in health care services have enhanced life expectancy, thus maintaining healthy dentition is significant for overall health. Furthermore, the growing desire of elderly patients to maintain their teeth has led to an increased need for the performance of complex dental treatments in elderly patients. Root canal therapy is an essential phase of such treatments. Elderly patients may exhibit one or more systemic conditions that require special care, in addition to other changes that occur within the dentition and oral mucosa because of aging. This makes root canal treatment in elderly patients a great challenge. This article reviews to characterize pathologic and physiologic changes in elderly patients that can interfere with root canal treatment procedures, as well as attitudes of elderly patients toward such treatment, and to provide guidelines and clinical considerations for the management of root canal treatment in elderly patients.

Keywords: Geriatrics, root canal treatment, endodontic treatment

Introduction

In this Modern era, aged patients are aware of their oral fitness and the cost of each tooth. To maintain overall health, complex dental treatments need to be performed to retain the tooth to provide a healthy dentition in the elderly. Endodontic treatments have been successively performed on patients ranging from the age of 2 to 96 yrs. Endodontic treatment plays a vital role as teeth is essential to maintain prostheses and overall health. Retention of teeth is a necessity in patients with systemic conditions that influences treatment decisions.

Certain dental practitioners have a misconception of the poor prognosis of root canal therapy in elderly patients due to factors like technical difficulties, physical and cognitive limitations, and disinterest in the preservation of their natural teeth.

Endodontic considerations are similar in many ways in the elderly patients as in the younger patients but there are many challenges from biological, medical and psychological differences in comparison with younger patients. Technically, elderly patients have an obliterated pulp space system, the root canal is usually narrow, though negotiation can be difficult. The technical challenges have to be overcome in biological old teeth with modified morphology of the pulp chamber and the root canal system. Establishing the glide path and the correct working length is the first step for completing extensive shaping and cleaning of the root canal system. Copious irrigation is obligatory for disinfecting the root canal walls.

Biology of Ageing

Saliva

As the age progresses, the use of increased number of drugs causes xerostomia (mouth dryness) as side effect. Saliva is the primary oral defense mechanism in maintaining tooth structure against oral infections as it contains multiple antimicrobial factors, buffering systems, supersaturated calcium phosphates, large lubricant molecules and digestive enzymes. Decrease in saliva causes rampant and severe oral diseases such as caries and Candida infection. Thereby compromising the quality of life as salivary moisture gives lubrication for taste, speech, chewing and swallowing [1].

Effect of Drugs

Generally prescribed medications for the elderly can root enlargement of gingival tissues (e.g. phenytoin sodium and calcium channel blockers) or induce lichenoid reaction (e.g. hydrochlorothiazide and ACE inhibitors or angiotensin II receptor antagonists). Clinical conditions, such as hypertension, anticoagulation therapy and hypoglycemia, can trigger emergency crises during dental treatment. If diabetes uncontrolled it often leads to cardiovascular diseases and are more susceptible to infections. Antibiotic prophylaxis may be essential for dental procedures in old age to prevent infection of replaced joints and cardiac prosthetic valves. Consultations with other health professions are often required to optimize patient care while dental health care workers provide their professional judgment regarding these special conditions^[2].

Enamel

As the age progresses the enamel undergoes both chemical and morphological changes. The enamel becomes less hydrated and fluoride content increases especially with the uses of fluoridated tooth paste, mouth rinses and fluoridated water. Enamel will have deteriorating effect because of the chewing cycles and brushing with the abrasive dentifrices so the thickness of the enamel changes overtime, especially on the facial, proximal contacts, and incisal and occlusal surfaces. The tissue interaction with acidic solutions changes overtime due to the decreased enamel thickness^[3].

Dentin

Age changes in dentin are clinically important. Continued growth referred as physiological secondary dentin formation and gradual obliteration of dentinal tubules referred as dentin sclerosis are age related changes that takes place in dentin. These processes occur simultaneously but are independent of each other. Odontoblasts in old teeth are scarcer and shorter than in young teeth. But number of dentinal tubules is reduced, and their course is somewhat more irregular due to crowding of the odontoblasts. Predentin width increases with age. Formations of secondary dentin reduce the pulp chamber. Secondary dentin formation apparently starts in apical region and proceeds coronally in impacted tooth. Obturation of tubules by gradual growth of peritubular dentin is typical age-related change that leads to a reduction in sensitivity of the tissue. Even adhesive properties of aged are different from that of young. To prevent ingress of toxic agents, reduction in dentin permeability is also important.

Pulp

Dental pulp of aged have more fibers and fewer cells than younger teeth. It is hard to envision how many of these changes are age dependent per se and which are produced by function of teeth or pathological process. The reparative capacities of the pulp of the older individuals will not be similar to the young teeth. Blood supply decreases, Cross linking between collagen fibers in pulp decreases and calcium content increases with age. Reduced sensitivity in teeth of older pulp may be related with decrease in pulpal calcitonin gene related peptide and substance P like immunoreactivity. Changes noted in nerve mark the hemoregulation of pulp and thus affect healing capacity of pulp in old individuals. Presence of pulp stone is attributed to pathological changes. The pulp is home to the nerves and blood vessels that supply the tooth. Calcified structures found in the pulp are called pulp stones. Pulp stones are one of the most entropic entities in the dental world. Nearly every characteristic that leads us

to describe them ends up in a range of possibilities. To begin with, pulp stones can either be found in the crown portion of the tooth or the root. They can be as small as 0.05 mm in diameter to as large as 4 mm. They can be found in milk teeth or permanent teeth. They might be found only in a single tooth or can be found in an entire dentition. One might encounter only 1 pulp stone or over 10 in number in a single tooth. In addition to these features, there are multiple theories that have tried to explain the formation of these blends of calcium and phosphorous. It is essential to know that pulp stones are of two primary types depending on their core contents. When a person ages, the pulp gradually diminishes in size. The most commonly accepted school of thought says that during this process, the secondary layer of dentin contributes chiefly to the formation of pulp stones. These forms of pulp stones are called true stones, where they are lined by the cells of dentin. If the cells of the pulp itself degenerate, they often get mineralized (impregnated with minerals) in the process leading to another type of pulp stones. These are called false pulp stones. These pulp stones may or may not be adhered to the walls of the dentin.

Cementum

Cementum gets resorbed both in resorption defects and generally over the root, especially apical half to compensate for tooth wear during function. The rate of resorption and number of resorption areas upsurges with age. Gingival recession exposes the cervical cementum to the oral atmosphere thereby losing the exposed cementum due to environmental factors.

Cementum is deposited gradually over a lifetime. The increased thickness of cementum results in widening of the major apical foramen and increasing the distance between the foramen and the radiographic apex.⁴

Age associated changes in oral mucosa

Ageing is related to progressive, irreversible deterioration of functional capacities of diverse tissues and organs and these modifications lead to an elevated probability of death of the organism as whole. It is clearly demonstrated in skin and comparable modifications may be predicted in oral mucosa and periodontium.⁵

Oral mucosa becomes progressively thin, smooth and dry with age with lack of elasticity and stippling. Tongue indicates marked clinical changes and turns smoother with loss of filiform papillae. Mucosa becomes vulnerable to minor injury. There is tendency of growing sublingual varices with advancing age and increasing susceptibility to diverse pathologic conditions such as candidal infections and reduced rate of wound healing have been reported.

Age associated changes in alveolar and basal bone

Some considers senile atrophy of alveolar bone known as continuous eruption are as normal ageing factors. Atrophy of bony margins must be taken into consideration as a slowly progressing, but superficially located pathological process.

Most apparent change with tooth loss is transformation and resorption of alveolar process. Remodeling results in reduction in height and loss on buccal side in upper jaw and on lingual side in lower jaw. Reduction in size of alveolar ridge is less with edentulous non-denture individuals than with denture wearers. And rate of resorption is influenced by nutritional deficiencies and avitaminosis. Resistance to periodontal disease is of high importance.

Multiple cysts in maxilla as well as in mandible are important

in elderly persons due to danger of spontaneous fracture. Radiographic examination is significant in positive diagnosis of complain of discomfort or pain.

Age associated changes in temporomandibular joint

The healthy elderly shows some structural differences in the temporomandibular joint compared to the young adult, but it could be more on adaptation to functional stress than a result of aging. Internal derangements of the disc occur more often in old people, but the associated tissue damage could represent the onset of osteoarthritis. Though signs and symptoms referable to the TMJ are similar in all age groups, currently the only factor clearly related to old age is restricted jaw opening.

Salivary gland diseases

The marked decrease in saliva production causes surface changes of oral mucosa. These pathological changes are basically due to extreme dryness. This inevitably decreases oral hygiene, increases caries activity and progresses towards periodontitis. Denture wearing becomes almost unbearable due to pain and burning sensation.

Malignancy

There is sharp increase in incidence with age. In general, elevated age carries with it a poorer prognosis, as does the position further back in the mouth the lesion is situated the poorer is prognosis. Primary neoplasms occur on lip, tongue or floor of mouth. Other parts of mouth and oral nasopharynx are also vulnerable. Lack of pain is very important point in differential diagnosis between the early phase of cancer and inflammatory lesion of oral cavity. Oral carcinomas occur much less frequently in individuals who have regular dental care. Many of the metabolic changes due to nutritional upset or systemic disease are known to be more common in elderly which have been suspected as creating an environment in which epithelial transformation may take place with subsequent malignant changes in it.

Clinical Considerations [6]

Attitudes of elderly patients towards root canal treatment.

Teeth retained through nonsurgical root canal treatment are highly valued by elderly patients. The primacies of elderly patients differ from those of younger patients. This difference may influence the treatment plan, as the objective of treatment in elderly patients is more closely guided by short-term goals and asymptomatic function than by esthetics and longtime stability. Elderly patients have positive attitudes towards nonsurgical root canal treatment but may refuse dental implants due to fear or cost.

Clinical considerations for elderly patients

There are various benefits by Preserving the teeth of the elderly patients

- Maintenance of an intact dental arch
- Increased retention of removable dentures
- Provision of abutments for fixed prostheses
- Preservation of occlusion, and
- Preservation of alveolar bone in cases treated by overdentures.

Requires Accurate knowledge, good technical skill, and experience in empathetic patient management is required for dental care in elderly patients. Root canal treatment in elderly patients is considered a great task due to technical difficulties

from a calcified and limited pulp chamber. The strategic importance of the tooth is crucial in determining whether to save the tooth by root canal treatment or perform extraction; however, root canal treatment is contraindicated in certain medical conditions like patients requiring radiotherapy to the head and neck region, and poor compliance (for example, in patients with Parkinson's disease, tremors, or dementia).

Diagnosis [7]

Diagnostic procedure

- Chief complaint: Patient's dental knowledge and ability to communicate
- Medical history (systemic condition and drugs)
- Dental history
- Subjective tests (absence of significant signs and symptoms are common)
- Objective tests: Pulp vitality testing
 - a) EPT, Routine pulp testing done, cold testing is said to be more reliable
 - b) Periapical testing

Pulps with a high degree of pulpal calcifications may give false negative responses to pulp testing procedures including heat, cold and electric pulp testing.

Radiographic Findings:	<u>Parallel and bitewing</u>
	<u>CBCT</u>

Treatment planning [8]

Both uncertainty and complexity is inherent in the treatment planning of the elderly making treatment decisions difficult. Prior to any clinical treatment planning, the following determinants to be considered

- Patient desires and expectations.
- Type and severity of patients' dental problems after evaluating the four domains of need such as function, symptoms, pathology, and esthetics.
- Impact on patient's quality of life in terms of ability to eat, comfort level, and esthetics that could affect self-image.
- Probability of positive treatment outcome.
- Availability of reasonable and less extensive alternatives.
- Ability to tolerate treatment stress.
- Patient's capability to maintain oral health, whether he or she is well motivated and can carry out independently or require assistance.
- Patient's financial resources.
- Life span.
- Family support - physical, psychological or financial.

Staged treatment plan

Stage I: Emergency care

Stage II: Maintenance and monitoring- includes management of chronic infection, root canal therapy, root planing and curettage, restorations of carious lesions, work related to dentures, patient education to improve oral health. A further period of evaluation is required before proceeds further.

Stage III: Rehabilitation phase - includes implants, surgical endodontics, surgical periodontics, esthetic rehabilitation, reconstruction of occlusal plane and restoration of vertical dimension.

Endodontic Considerations [9, 10, 11, 12]

During anesthesia

In older patients, anatomic landmarks that are used as guides for needle placement during block and infiltration injections are usually more evident. While selecting anesthesia, the effects of epinephrine must be considered for routine endodontic procedures. It should be deposited very slowly (and skeletal muscle avoided) if epinephrine is the vasoconstrictor. The reduced width of the periodontal ligament makes needle placement for supplementary intraligamentary injections more difficult. The majority of patients receiving an intraosseous injection of 2% lidocaine with 1:100,000 epinephrine (correct ratio) solution experience a transient increase in heart rate. This would not be clinically significant in most healthy patients, but in the older patient whose medical condition, drug therapies, or epinephrine sensitivity suggests caution. 3% mepivacaine is a good alternative for intraosseous injections. The reduced volume of the pulp chamber makes intrapulpal anesthesia difficult.

Isolation

- 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)

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.

Measuring working length

Electronic apex locator is helpful to define work length, especially when problems arise when defining the work length. The work length should be 1mm less than the work length that is recorded so the apical stop can be placed at the apical constriction.

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 [13]

There is no approach of choice for root canal filling although lateral cold and vertical warm obturation with gutta-percha is often performed and documented.

Success and failure of endodontic treatment

Recovery after root canal treatment is the determining factor for the success of endodontic treatment. Ingle stated, the success in geriatric patients is better compared to other age groups as one third area of root canal is fully obstructed by secondary cementum and root canal ramification is much reduced.

Endodontic Surgery

Generally, considerations and indications for endodontic surgery are not affected by age. Medical considerations may require consultation but do not contraindicate surgical treatment when extraction is the alternative. Many older patients receive low-dose aspirin therapy to prevent blood clot formation and may subject to embolic formation if the treatment is interrupted. Aspirin therapy should be continued throughout dental procedures, even during extraction or surgery.

Conclusion [14]

Geriatric endodontic gains more significant role in complete dental care because of the "aging society". Dental services including root canal procedures, for the elderly population of the future are anticipated to be of two general types (i) services for the relatively healthy elderly who are functionally independent and (ii) services for elderly patients with complex conditions and problems who are functionally dependent. The second group will require care from practitioners who have specialized and advanced training in geriatric dentistry. This age group being targeted in dental education programs and advanced training through improved curriculum, research and publication on aging.

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