

When should root remnants and unrestorable broken teeth be extracted in frail older adults?



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ABSTRACT

Background. Many frail older adults have an unhealthy dentition; unrestorable broken teeth and root remnants with open root canals, commonly accompanied by periapical and periodontal inflammation, are often seen. Improving oral health in the growing group of frail older adults with remaining teeth is a considerable challenge for dental care professionals. Dentists are often uncertain how to deal with root remnants and unrestorable broken teeth in frail older adults.

Methods. The authors aim was to provide recommendations to dentists to help in their clinical decision making about the extraction or retention of roots remnants and broken teeth in frail older adults.

Conclusions. Decisions about the extraction or retention of root remnants should be made on the basis of preventing pain and oral discomfort, preventing severe inflammation, and preventing additional decline in oral health. Both root-related and patient-related factors are considered.

Practical Implications. Decision-making trees can help dentists decide whether to extract root remnants and unrestorable broken teeth in frail older adults.

Key Words. Frail elderly; poor oral health; root remnants; dental infection; clinical decision making.

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The proportion of older adults in society is increasing.¹ Statistics Netherlands predicts that life expectancy at age 65 years will have increased by 20.5 years by 2023.² Owing to improved oral health care and oral health awareness, many older adults are able to retain their own teeth until later in life.^{3,4} In 2016, approximately 40% of older adults (≥ 75 years) in the Netherlands had teeth remaining, and this number is expected to increase in the next decades.⁵ While they are aging, many older adults become frail. Frailty is defined as a state in which older adults are vulnerable to sudden changes in health status because of a decline in physiological function and reserve.⁶ When older adults become frail, care-dependent, and homebound, attention to oral health care often declines.⁵

Important reasons for this decline in personal oral health care are cognitive impairment and physical disability (that is, gross and fine motor problems).^{7,8} In addition, both home-dwelling and institutionalized older adults visit a dentist less frequently due to lack of perception of need for oral health care, worsened systemic and functional health, nervousness and fear about visiting the dentist, finances, declined mobility, and poor accessibility of the dental office for older adults with walking aids or wheelchairs.⁹⁻¹¹ As a result of these constraints, many frail older adults have developed problematic and unhealthy dentition. Homebound older adults or older adults residing in a nursing home are particularly at risk of having poor oral health.^{3,5} Caries, root remnants, and broken teeth with open root canals and inflammation of the gingiva are often seen in these frail older adults.³ This is not without consequences for general health and well-being. Researchers have found that poor oral health has a negative impact on general health, masticatory function, nutritional status, social well-being, and oral health-related quality of life.¹²⁻¹⁴ Therefore, attention to oral health in frail older adults should not be neglected.

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Improving oral health in this ever-growing group of frail older adults with remaining teeth is a considerable challenge for dental care professionals for several reasons. First, the dental situation in frail older adults is often complex owing to teeth with extensive restorations, crowns, bridges, and endodontically treated root canals; broken teeth; dental implants; lack of occlusion; periodontal disease; and poor or impaired oral hygiene.^{15,16} Second, multimorbidity and polypharmacy can interact with oral health and dental treatment.^{17,18} Third, cooperativity for oral care is often complicated by impaired general condition; cognitive decline, which can result in fear or aggressiveness toward dental care professionals; and lack of dental awareness among older adults and their caretakers.^{19,20} For these reasons, the necessary oral care is often not implemented or fails. Additional underlying reasons for this failure to implement proper oral care is the gap in knowledge with regard to the specific oral care these frail older adults need among caretakers who are involved in geriatric care, as well as a lack of guidelines regarding effective methods to provide oral care and improve oral health in these patients, especially in older adults with dementia.⁷ Owing to this gap in knowledge and absence of treatment guidelines, dental care professionals, as well as geriatric caretakers, are reluctant about invasive dental treatment in frail older adults, including the need to extract root remnants and unrestorable broken teeth.

Prevalence of root remnants in the general population ranges from 11% through 37%.²¹ However, this number is based on radiographic studies only. In care-dependent older adults, for whom radiographic assessment is often not possible, clinical prevalence of roots or broken teeth is much higher; it has been reported to be 62%.⁵ Root remnants and unrestorable broken teeth are clinically present more often in older adults with dementia than in older adults without dementia, which might be a result of higher caries prevalence, fewer dental examinations, care-resistant behavior, and decreased verbal communication skills regarding dental problems and pain.²²

METHODS

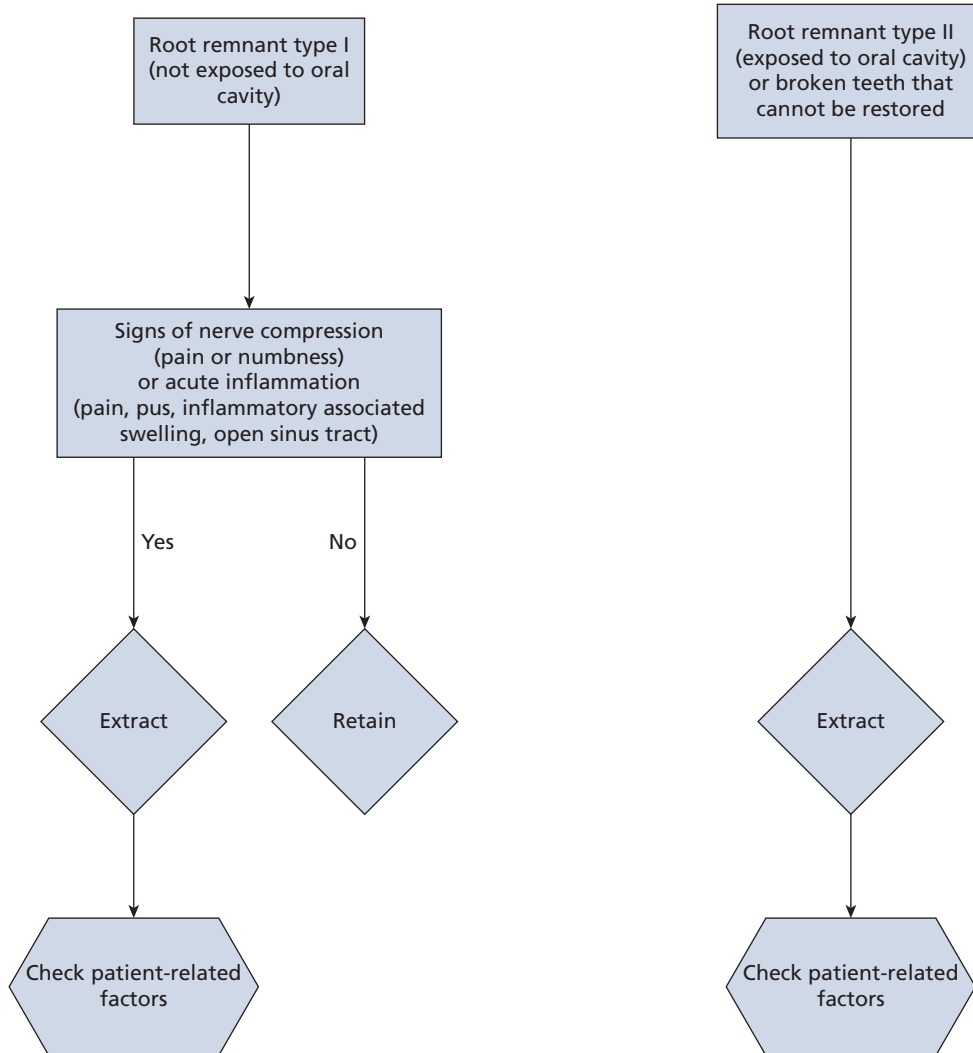
Decision making about extraction of root remnants or unrestorable broken teeth in frail older adults is a complex process, as many factors must be taken into account. Among these factors are the ability of the patient to express pain or discomfort; radiographic or clinical signs of inflammation and infection; general condition of the patient, including life expectancy; extent of the surgical procedure needed; and risk of developing complications if the root remnant or unrestorable broken teeth is left untreated. As there is, to the best of our knowledge, no literature on decision making about whether to extract or retain root remnants and unrestorable broken teeth in frail older adults, our aim was to provide recommendations for clinical decision making about the extraction or retention of root remnants and broken teeth present in frail older adults on the basis of the following clinical concepts: preventing pain and oral discomfort; preventing severe infection and inflammation, as continuous inflammation in the oral cavity can have systemic consequences²³; and preventing additional decline in oral health. Both root-related and patient-related factors are taken into account.

Factors related to root remnants and unrestorable broken teeth

On the basis of a comprehensive study published in 1961 of 3,874 routine full-mouth radiographs, Dachi and Howell²⁴ distinguished 2 types of roots remnants (type I and type II), which differed considerably in their susceptibility to infection. A type I root remnant is a root fractured during extraction that, after the process of socket healing, becomes completely or almost completely enclosed with bone and is not exposed to the oral cavity. A type II root remnant is the root remnant that results from spontaneous fracture of the dental crown due to caries or other factors and has remained exposed to the oral cavity and oral fluids. We also consider unrestorable broken teeth to be type II root remnants.

Most type I root remnants are symptomless.^{25,26} They can, however, cause pain, numbness, or nerve compression, especially when a denture base or flange impinges close to the root fragment.²¹ These are the only cases in which type I root remnants must be extracted (Figure 1A). If the type I root remnant is detected as an incidental radiographic finding and is not associated with any symptom or pathology, extraction is not indicated. On the basis of a clinical survey on 2,000 patients referred for extraction of root remnants, Helsham²⁵ stated that the resorption of

Root-related factors



A

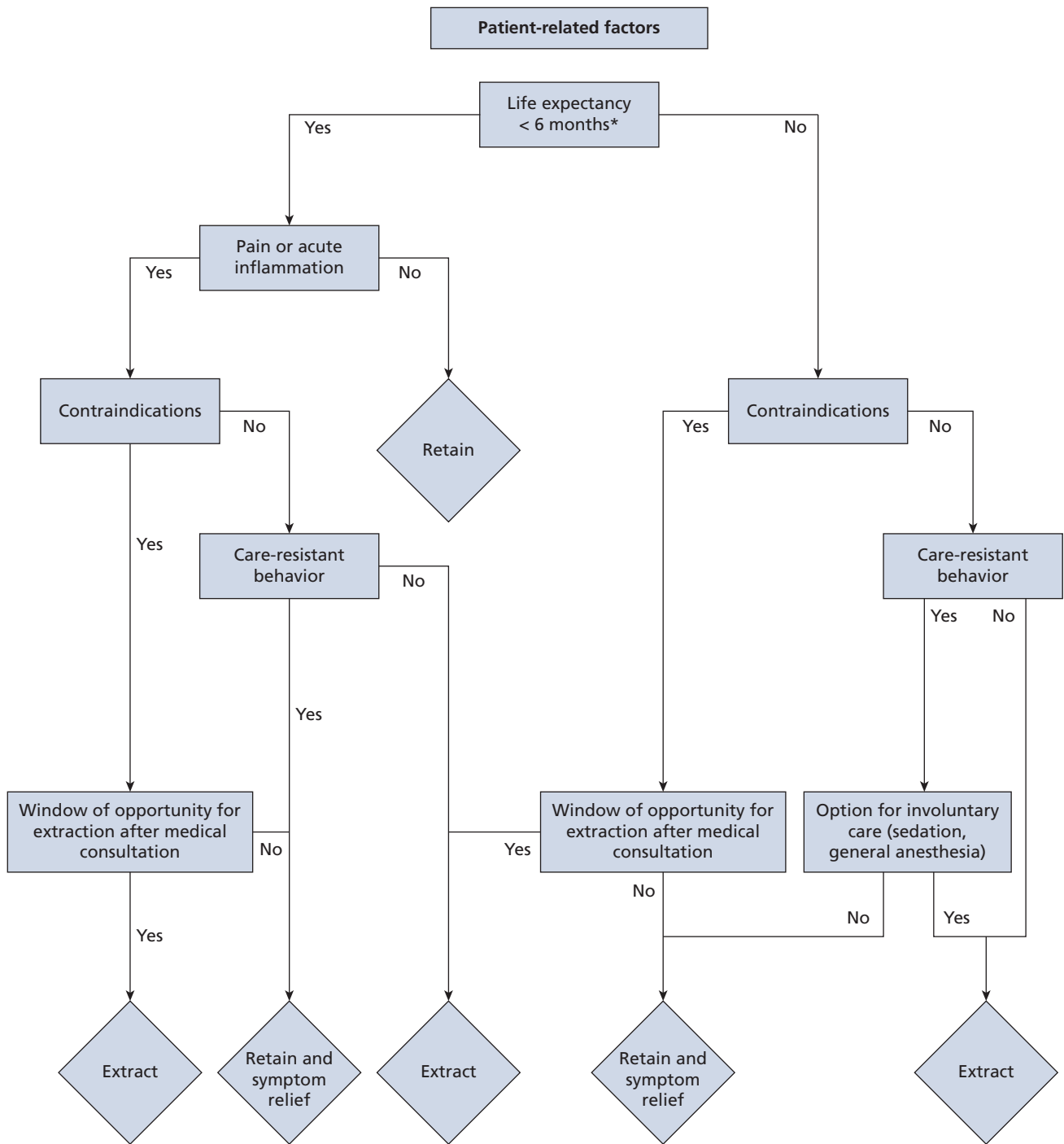
Figure 1. A. Factors related to root remnants and unrestorable broken teeth. **B.** Patient-related factors. The treatment plan resulting from the decision tree is discussed with the patient and caretakers to adapt the proposed treatment plan to match it with the patient’s expectations and preferences when needed before informed consent is obtained. * For patients with a limited life expectancy, the family physician and other caretakers are always consulted first about whether they agree with the palliative or curative care proposed.

the alveolar process—bringing type I root remnants to the surface and becoming type II root remnants—increases the risk of developing pathology. Type II root remnants, which are like the unrestorable broken teeth connected to the oral cavity, account for most pain, inflammation, or pathologic change.²⁵

Radiographic Signs of Inflammation

Although the presence or absence of inflammation cannot always be determined on a radiograph, the likelihood of inflammation associated with a root remnant with areas of radiolucency is greater than if radiolucent areas are not present.^{24,26} When radiolucency is present on the radiograph that is associated with the root remnant, this radiolucency is highly suspect for the presence of granulation tissue or a cyst.²⁵ Dental radiographs usually are sufficient to detect such pathology; in unclear cases, a cone-beam computed tomographic scan can be of additional help.

Type II root remnants are associated with far more radiographic signs of infection than type I root remnants.²⁴ Although type II root remnants exhibited associated radiolucency in 80% of cases, type



B

Figure 1. Continued

I root remnants were associated with radiolucency in only 20% of cases. The size of a root remnant had no influence on the incidence of associated radiolucency areas. The maximum size of the root fragment that is acceptable to leave behind when a root is fractured during extraction is still not set.²¹

Clinical Signs of Severe Inflammation and Pain

Pain, infection, and pathologic change are, by far, more common in roots remnants exposed to the oral cavity. This observation is equally true for initial exposure and for later exposure to resorptive processes.²⁵ Most commonly in the presence of pain, the type II root remnant is associated with a periradicular radiolucency, and caries is frequently seen in root remnants with direct

communication with the oral cavity.²⁶ Communication between the oral cavity and the periradicular space can lead to inflammation of the pulpal or periradicular tissues with or without necrosis of the root canal. Acute inflammation might follow, or the tissues might heal again, leaving the root just below the surface with an area of granulation tissue surrounding it. There is clinical evidence that acute inflammation can occur at any time, specifically when the immunity of the patient is compromised.²⁵ Another possibility is cyst formation, which can become infected subsequently.²⁵ To prevent infections, ideally all type II roots should be extracted.

Oral Hygiene and Discomfort

Type II root remnants, including unrestorable broken teeth, have the propensity to be plaque-retentive, have caries, and often have an open pulp canal. In addition, type II roots can cause pain and discomfort by means of damaging mucosal tissues because of sharp edges. Type II roots can cause an unattractive dental appearance, not only because of plaque-retentiveness, but also because of caries and oral malodor. Given the fact that oral hygiene is usually poor in frail older adults patients, ideally every type II root and unrestorable broken tooth should be extracted to improve oral health. Rarely, retention of the root remnant type II is optional when periodontal and periradicular tissues are healthy, oral hygiene is optimal, and the root remnant is functional, for example, preserving alveolar bone or supporting a partial denture. In these cases, recontouring sharp edges and restoration of open pulp canals are required.

Patient-related factors

Life Expectancy

When the physical and mental condition of older adults is declining progressively, in such a way that they become completely care-dependent, bedridden, or receive palliative care, it can be expected that the patient's life span will be short. The patient's life span can be based on frailty, gait speed,²⁷ sarcopenia, age, and the "surprise" question (that is, would you be surprised if this patient were to die in the next year?).²⁸

In oral palliative care, with a patient's life expectancy of less than 6 months, root remnants should only be extracted when they cause pain or severe inflammation and extraction is not expected to be complicated (Figure 1B). If extraction is necessary but not possible due to patient-related factors, or a complicated extraction or postoperative complication is expected, then the guiding principle is symptom relief. Symptom relief can be achieved with pain medication, recontouring sharp edges, and oral hygiene measures, when needed, supported with antiseptic measures. Antibiotics should be prescribed only when all the other measures fail or are insufficient.

Ability to Treat

Older age is often considered as a barrier to extract root remnants. However, age itself is not a limitation, but factors such as age-related diseases (for example, Parkinson disease, dementia, stroke, cardiovascular disease, and organ failure), changes in personality, and ability to adapt to stress, can influence oral health care decisions and the ability of the patient to cooperate with dental treatment. Understanding the physical and psychological changes that occur with aging can help dental care professionals design the optimal oral health care program in their frail older adult patients.²⁹

The ability of the patient to cooperate with dental care professionals is essential for receiving decent oral health care and dental treatment. Limitations regarding posture or position can mostly be overcome with creativity and attributes (for example, a vacuum granule pad of pillows). In case of care-resistant behavior due to cognitive decline, extraction of root remnants can become complicated. In these cases, behavioral and pharmacologic strategies are available.³⁰ Behavioral measures (for example, coping strategies or presence of a family member) are preferred and can provide a solution in many cases.^{31,32} When these behavioral measures fail to reduce the anxiety and aggression sufficiently, dental care professionals, together with other caretakers and the legal representative, have to decide whether they will take the step toward providing involuntary care by means of sedation or general anesthesia. This is a difficult situation, which is addressed in the Dutch Involuntary Care Act (*Wet zorg en dwang*).³³ Involuntary care should be provided only when no other options are available. As cognitive decline and development of care-resistant behavior increases with age, prevention of oral health problems during the final stage of life is important.

Risk of Developing Complications

Extraction of type II root remnants is considered a relatively safe procedure.³⁴ Type II root remnants can usually be extracted easily, as they are often periodontally or periapically affected. Furthermore, the extracted root remnant leaves a relatively small wound surface. In geriatric patients, however, in whom polypharmacy and comorbidities are often present, the risk of developing complications can be increased. Therefore, when root remnants are to be extracted in frail older adults, some modifications and measures, such as staging of the number of extractions, adjustments of medication, and prescribing antibiotics or tranexamic acid, have to be taken to minimize the risk of developing complications.

In case of absence of pain and acute infection, contraindications for extraction of root remnants or unrestorable broken teeth include myocardial infarction and cerebrovascular accident (3-6 months) and prosthetic valve surgery (6 months-1 year).³⁵ Patients with impaired hemostasis must have a preoperative evaluation. If extraction of the root remnants is necessary, measures should be taken, such as staging the extractions in more than 1 session and performing the extractions in a hospital environment when proper hemostasis cannot be achieved (international normalized ratio, > 3.5).^{36,37} Extraction is also contraindicated in severely immunocompromised patients and patients undergoing active cancer therapy, as the patient becomes susceptible to infection and compromised wound healing. Extraction should also be avoided as much as possible in patients taking intravenous bisphosphonates or patients who have received a high cumulative dose of radiation in the area with the root remnant.^{35,38} When acute inflammation or pain occurs in these cases, medical consultation is necessary for selecting the windows of opportunity for extraction or for additional measures. In rare cases, it might be necessary to prevent osteonecrosis via pulpotomy or endodontic treatment, although these treatment options can be complicated when the patient is homebound or not able to maneuver the head. Furthermore, the difficulty of obtaining a radiographic assessment and obliteration of the root canals are complicating factors.³⁹

Before starting comprehensive therapy (for example, intravenous administration of bisphosphonates, head and neck radiotherapy, transplantation surgery, or chemotherapy, which have an impact on the oral component), medical specialists should refer their patients to a dental care professional for a screening for oral pathology.

Informed Consent

Use of our proposed decision tree can assist dental care professionals with clinical decision making on extraction or retaining root remnants in frail older adults. This decision tree is based on both objective treatment needs and needs expressed by patients to fine-tune the treatment plan (a patient-centered care approach). The treatment plan resulting from the decision tree is discussed with the patient and caretakers to adapt the proposed treatment plan to match it with the patient's expectations and preferences when needed before informed consent is obtained.

Clinical decision making on extraction of root remnants in frail older adults: 3 cases

Case 1

A 76-year-old man was admitted to a nursing home owing to severe dementia. During intake, the institution's dentist performed an oral health screening. In addition to dementia, the patient had cardiovascular disease. The patient's medication list consisted of direct oral anticoagulants, antihypertensives, statins, and a sleep medication for incidental use. As he could walk without walking aids and participated in social activities in the nursing home, his life expectancy was assumed to be more than 6 months. Intraoral inspection revealed 3 type II root remnants (teeth nos. 19, 22, and 28) covered with plaque and surrounded with inflamed periodontal tissue (Figures 2A and 2B). He expressed no oral pain; however, it was questionable whether he was able to express pain because of his impaired cognition. His full dentures were not worn anymore. The panoramic radiograph revealed the presence of impacted third molars as well. Periapical radiolucency was noticed around the root remnants (Figure 2C). Because of the inflamed periodontal and periapical tissues, it was decided to extract the type II root remnants. Contraindications were not present, and the patient showed no care-resistant behavior. Healing after removal of the root remnants was uneventful.

Case 2

An 86-year-old woman was seen for an oral health screening by a geriatric dentist at a nursing home where she had been admitted owing to dementia. In addition to dementia, she had atrial fibrillation, for which she did not require medication. Her cognitive abilities were still reasonable, and her physical mobility and muscle strength were adequate. Her life expectancy was assumed to be more than 6 months.

Intraorally, several remaining teeth, multiple root remnants with open pulp canals (teeth nos. 5, 18-20, 29, and 30), caries, and gingivitis were seen (Figure 3). The patient's oral hygiene was ineffective, although she had help from others. No oral pain symptoms were noticed (Figure 2). Oral radiographs could not be obtained in the nursing home, and transportation to a dental office was complicated owing to logistic problems. Therefore, no radiographic images are available. Because the patient had a life expectancy of more than 6 months, contraindications for removal were absent, and she showed no care-resistant behavior, it was decided to extract the type II root remnants in 3 sessions. No complications occurred. She had no wish for prosthetic treatment, otherwise 2 partial dentures could have been made.

Case 3

A 100-year-old, frail woman was seen for a dental consultation at her home where she lived with her son. She was totally care-dependent and homebound owing to severe sarcopenia. She slept almost all day and was unable to leave her bed. Therefore, she received formal home care. One of the home care nurses asked whether the dentist could come over, as she has noticed some broken teeth. The patient's life expectancy was assumed to be less than 6 months owing to her age and severe sarcopenia.

Intraorally, almost all teeth were broken in the maxilla (Figure 4). In the mandible, 6 front teeth were present, of which 1 was broken. All root remnants had open pulp canals (teeth nos. 3, 5-13). Furthermore, plaque-accumulation, calculus, caries, and gingivitis were seen. The patient's oral self-care was ineffective. She brushed her dentition without the aid of others. Apart from some sharp edges on the teeth, she had no oral pain symptoms. Owing to immobility, the patient could not be transferred to the dental office to obtain oral radiographs.

The patient indicated that she did not need dental treatment because she did not experience oral pain. As her life expectancy was less than 6 months and there were no signs of pain or acute inflammation, it was decided to retain the root remnants. The sharp edges were recontoured using a mobile dental unit. The patient passed away a few months later. During these months, the patient did not experience oral pain.

DISCUSSION

Our aim was to help dental care professionals make clinical decisions on the extraction of root remnants and unrestorable broken teeth in frail older adults. Different opinions exist about whether root remnants or broken teeth that cannot be restored in frail older adults should be extracted. Decision making regarding this topic is often difficult, as many patient- and root-related factors have to be taken into account. Next, the decision whether to extract in these cases is often based on personal feelings and previous (unpleasant) experiences regarding the dental care professional. Our observation is that type II root remnants and unrestorable broken teeth in frail older adults are often unnecessarily retained, especially when patients do not have obvious symptoms or do not express these symptoms. Although type II root remnants do not always cause symptoms, in many cases there is a risk of developing severe (systemic) inflammation and they generally impair oral health, oral function, and quality of life, which are important in frail older adults.

Reasons mentioned by dental care professionals for retaining type II root remnants are fear of complications in these often medically compromised frail older adults, inexperience with care-resistant behavior, and low levels of experience in extracting root remnants. In some cases, it is not possible to obtain oral radiographs, which makes it even harder to decide whether a root remnant or broken teeth should be extracted. Research regarding this topic is scarce, and guidelines are absent. Therefore, we propose a decision tree (Figures 1A and 1B) based on root-related and patient-related factors to help dental care professionals make more structured clinical decisions regarding extraction or retaining root remnants in frail older adults. We hope that this decision tree will help dental practitioners make clinical decisions on the basis of the available knowledge and

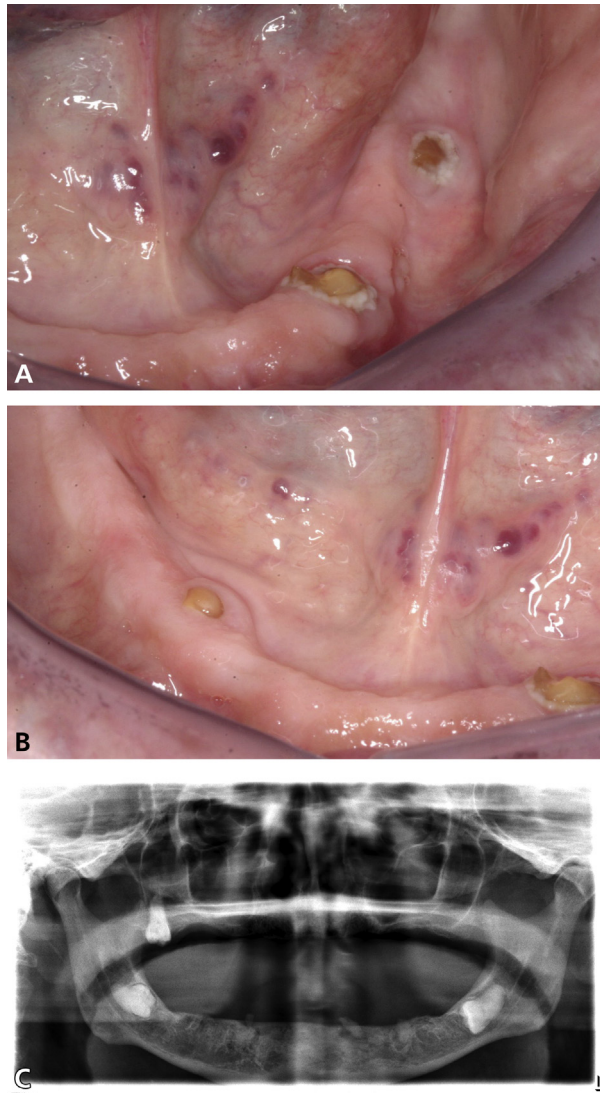


Figure 2. Case 1. **A.** Intraoral situation of the left side of the mandible. **B.** Intraoral situation of the right side of the mandible. **C.** Panoramic radiograph of the maxilla and mandible.



Figure 3. Case 2: Intraoral situation.

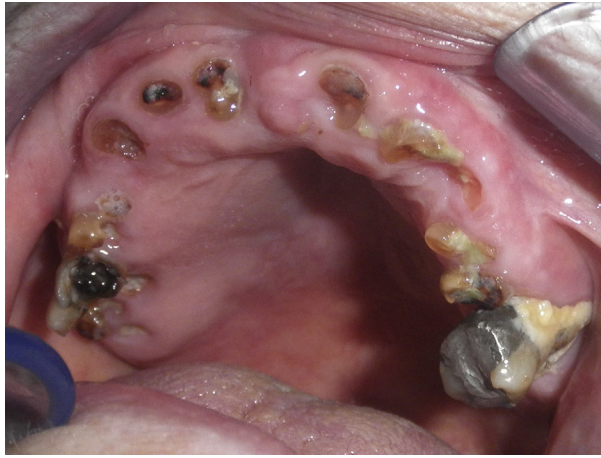


Figure 4. Case 3: Intraoral situation of the maxilla.

expertise, keeping in mind that geriatric dentistry is not only aiming to “heal the disease,” but also to prevent disability and improve and maintain the functional oral capacities of older adults.¹ In this light, next to assessment of root-related factors, extraction of type II root remnants and unrestorable broken teeth in frail older adults should always be attempted after careful consideration of all the patient-related factors, including the patient’s lifespan.

CONCLUSIONS

Extraction of type II root remnants and unrestorable broken teeth in frail older adults should be attempted after careful consideration of root- and patient-related factors. ■

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