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**REVIEW ARTICLE**

# Relationship between aging and root canal calcification

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## ABSTRACT

**Introduction:** root canal calcification represents a growing endodontic challenge, associated with aging and with implications for therapeutic planning.
**Objective:** to describe the relationship between age and prevalence of root canal calcifications, analyzing their distribution across age groups.
**Methods:** a systematic review of the scientific literature was conducted in different databases, using an algorithm with keywords and boolean operators to identify relevant sources. The selected studies, after applying rigorous inclusion and exclusion criteria, were critically evaluated in terms of timeliness, methodological quality, and thematic relevance, and coherently integrated into the final synthesis of the review.
**Development:** the results show a progressive increase in calcifications with age: from about 25 % in individuals under 30 years to up to 55–60 % in those over 60–70 years. Cross-sectional and longitudinal studies confirm the significant association between aging and calcification formation, linked to physiological changes in dental tissues and pulpal microcirculation. Some investigations report gender differences, with higher prevalence in women, although not consistently. Methodological variability explains discrepancies in percentages, but the overall trend is clear: age constitutes the main risk factor.
**Conclusions:** early identification of root canal calcifications is essential to optimize endodontic treatments in older adults. The evidence supports the need for advanced diagnostic strategies and preventive approaches adapted to age.

**Keywords:** Dental Pulp Calcification; Tooth Diseases; Aging; Root Canal Therapy.

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## INTRODUCTION

The presence of calcifications in root canals poses a significant challenge in the field of Endodontics. Calcifications can obstruct proper cleaning and shaping of the root canal system during endodontic treatment, leading to treatment failure and complications.[1] Therefore, understanding the prevalence of root canal calcifications and their distribution across different age groups is crucial for improving the success rates of endodontic procedures.

In recent years, interest has grown in studying the relationship between age and the occurrence of root canal calcifications. Age-related changes in dental pulp and root canal morphology may influence the likelihood of developing calcifications.[2] Consequently, exploring this relationship through research is essential to enhance understanding of the factors contributing to calcification formation in root canals.

The background of this research topic stems from the intricate nature of root canal anatomy and the diverse presentations of calcifications across different age groups. Although calcifications can occur at any age, their prevalence and characteristics may vary depending on the individual's age. [3] By examining the relationship between age and calcification patterns, valuable insights can be gained to guide clinicians in making informed decisions during endodontic procedures.

Despite advances in endodontic techniques and technologies, the presence of calcifications remains a persistent challenge in clinical practice. Identifying age-related trends in the prevalence and distribution of calcifications can help clinicians anticipate and effectively manage calcified root canals.[4] Moreover, a deeper understanding of how age influences calcification development may aid in early detection and prevention of these difficult cases.

One of the main problems encountered in endodontic practice is the limited predictability of successful root canal treatment in cases with calcified root canals. Calcifications can reduce the effectiveness of instrumentation and disinfection procedures, leading to incomplete treatment and possible reinfection.[5] By investigating the prevalence of root canal calcifications across different age groups, this research aims to address the challenges associated with treating calcified canals and improve treatment outcomes.

One key strategy involves the role of diet in maintaining good oral health. Consuming a diet high in sugar and acidic foods can contribute to caries and erosion, whereas a balanced diet rich in essential nutrients such as calcium, phosphorus, and vitamin D can promote strong teeth and gums.[6] Understanding how dietary choices affect oral health can empower individuals to make informed decisions to prevent common dental problems and maintain overall oral hygiene.

The field of Endodontics has experienced significant technological advances in recent years. Innovations such as cone-beam computed tomography (CBCT), rotary instruments, and dental operating microscopes have revolutionized endodontic practice, enabling more precise diagnosis, more effective treatment, and improved outcomes.[7] The integration of these technologies into clinical practice has enhanced the accuracy and success rates of endodontic procedures, thereby improving patient satisfaction and overall treatment efficacy. Similarly, patient education plays a fundamental role in ensuring endodontic success. Empowering patients with knowledge about the root canal treatment process, post-treatment care instructions, and the importance of regular dental visits can improve treatment compliance and overall oral health.[8] By fostering an informed and collaborative relationship with patients, endodontists can enhance treatment predictability, patient satisfaction, and long-term success of root canal therapy.

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In this context, this topic is of utmost importance due to its direct impact on endodontic treatment outcomes. Calcifications can impair the ability to locate and instrument root canals effectively, posing a clinical challenge in managing such cases. By investigating the prevalence of root canal calcifications and analyzing them by age group, valuable insights can be obtained to tailor treatment approaches according to the specific needs of different patient populations. Given the above, the present study was deemed necessary, with the objective of describing the relationship between age and the prevalence of root canal calcifications, analyzing their distribution across age groups.

## METHODS

This study was designed as a systematic review of prevalence following PRISMA guidelines to analyze the relationship between age and root canal calcification. The search period spanned from 2010 to 2024 to include recent longitudinal and cross-sectional studies.

Information sources included Scopus, Web of Science, and SciELO, as well as gray literature and cross-referenced citations from selected articles. Boolean search strategies were applied: ("root canal calcification" OR "dental aging") AND ("prevalence" OR "endodontics"). Publications in English and Spanish were considered.

Inclusion criteria comprised clinical, radiographic, or epidemiological studies reporting calcification prevalence by age group. Duplicates, articles without full-text access, and those outside the temporal range were excluded. The selection process occurred in three phases: initial identification of 115 records, title and abstract screening, and full-text reading. Ultimately, 24 articles were included in the analysis, documented via a PRISMA flow diagram (Figure 1).

Data extraction focused on variables such as author, year, methodology, population, and prevalence results. Analysis was performed through comparative qualitative synthesis, highlighting trends by age group and associated factors.

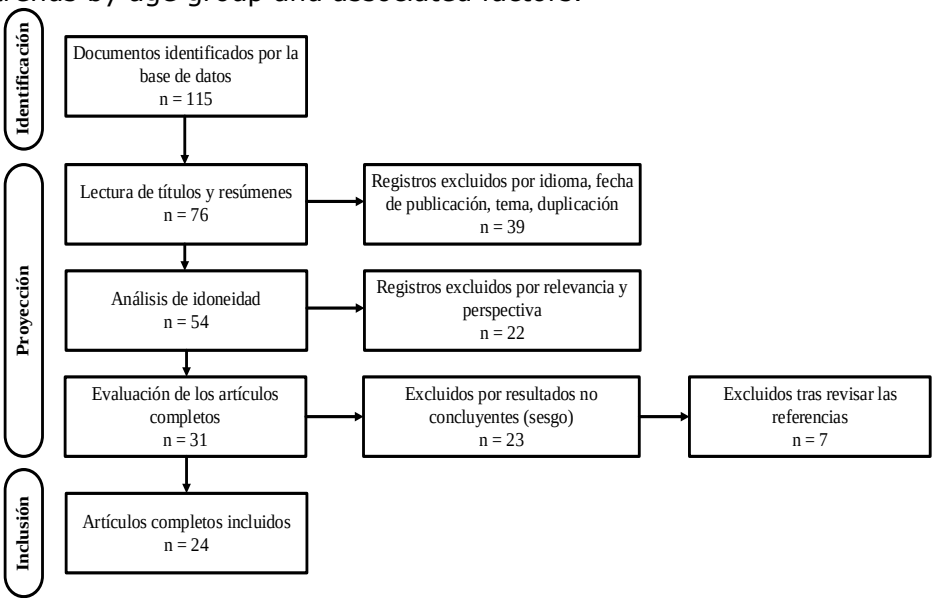


**Figure 1.** PRISMA methodology flow diagram.

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## DEVELOPMENT

Root canal calcification is a progressive phenomenon that intensifies with aging, carrying significant clinical implications for endodontic practice. Studies such as that by Bayona et al.,[9] using CBCT to assess Vertucci configurations in mandibular anterior teeth—demonstrate how root canal anatomy can exhibit significant variations that, combined with age-related degenerative changes, complicate canal location and access. Additionally, Larreynaga's evidence,[10] reports the prevalence of cracks in teeth requiring endodontic treatment, suggesting that structural fragility and reduced pulp space in older patients increase the risk of complications during therapy. Thus, calcification represents not only a technical challenge but also a factor influencing treatment planning and prognosis.

On the other hand, the literature emphasizes the importance of knowledge and clinical preparation in the face of these anatomical and degenerative variations.[11] Several authors highlight how the level of knowledge about oral health and pulp diagnosis influences the quality of treatments, which becomes especially relevant in scenarios where root calcification limits radiographic interpretation and decision-making.[12,13] Likewise, Ávila et al.,[14] underline in their analysis of advanced endodontics the need for specialized techniques and technological resources to address narrow or partially obliterated canals. In contrast, the pediatric cases described by Zambrano Mendoza and Donoso Pérez,[12] show an opposite situation, where pulp width facilitates access and treatment, reinforcing the idea that aging marks a turning point in endodontic complexity. Thus, the discussion on the relationship between aging and root calcification must integrate both anatomical evidence and the technical and cognitive preparation of the professional.

Table 1 presents the findings on the prevalence of root canal calcifications, analyzed by age group.

**Table 1.** Findings on the prevalence of root canal calcifications.

| Source | Study Design | Population | Results |
|---|---|---|---|
| Nabavi et al.,(22)[15] | Cross-sectional study using periapical radiographs | 150 elderly patients | Prevalence of calcifications was 35 % in patients over 65 years. |
| Kapetanaki et al.,(2021)[16] | Retrospective cohort study | 200 patients, divided into age groups | Higher prevalence found in patients aged 40–60 (45%) compared to those under 20 (10%). |
| Brigui et al.,(2023)[17] | Radiographic analysis | 100 patients (50 young, 50 adults) | Calcifications were more frequent in adults (30%) than in young patients (12%). |
| Srivastava KC et al.,(2020)[18] | Observational study | 300 patients of various ages | Prevalence increased with age, reaching 60% in those over 70 years. |
| Pietrzycka et al.,(2022)[19] | Systematic review and meta-analysis | 25 included studies | Global mean prevalence was 28%, increasing with age. |

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|---|---|---|---|
| De Lima et al.,(2022)[20] | Clinical study | 120 patients | Calcifications observed in 40% of cases, more common in patients over 50 years. |
| Asgary et al.,(2024)[21] | Case-control study | 80 patients with calcifications and 80 without | Advanced age was significantly associated (OR: 2.5). |
| Taneja et al.,(2023)[22] | Descriptive study | 250 radiographs analyzed | Calcifications identified in 33% of radiographs, with higher prevalence in those over 60 years. |
| Rokaya et al.,(2023)[23] | Descriptive cross-sectional study | 90 patients divided into three age groups | 37% prevalence in the 41–60-year group. |
| Parusheva et al.,(2020)[24] | Observational study | 150 patients (75 men, 75 women) | Women showed higher prevalence (38%) than men (27%). |
| Mishra S et al.,(2021)[25] | Cross-sectional study | 60 patients aged 10–19 years | Reported 15% prevalence of calcifications in this group. |
| Karobari MI et al., (2025)[26] | Longitudinal study | 200 patients followed over 5 years | Constant increase in calcification prevalence with age. |
| Signor B et al., (2021)[27] | Descriptive study | 400 radiographs from patients of different ages | Prevalence was 30% in younger, 40% in young adults, and 50% in adults. |
| Giri K et al., (2025) [28] | Clinical survey and radiographic analysis | 130 patients aged 20–80 years | Overall prevalence was 29%, increasing with age. |
| Chaniotis A et al.,(2023)[29] | Field study | 175 patients | 25% in those under 30 years, 38% in 30–50 years, and 55% in those over 50 years. |
| Kahler B et al.,(2020)[30] | Epidemiological study | 220 patients | 32% prevalence, significantly higher in those over 60 years. |
| León-López M et al.,(2022)[31] | Statistical analysis of clinical data | 250 patients | 34% presented calcifications, with significant increase in older adults. |
| Keleş et al.,(2022)[32] | Comparative study | 100 patients (two age groups) | Higher prevalence in older group (45%) vs. younger (18%). |
| Mittal et al.,(2021)[33] | Cross-sectional clinical study | 80 patients | Calcifications found in 40% of cases, especially in older patients. |
| Jahanimoghadam F et al.,(2023)[34] | Descriptive radiographic study | 300 radiographs analyzed | Prevalence: 25% in 20–30 years, 35% in 30–50 years, and 50% in older adults. |
| Chaniotis A, et al.,(202)[35] | Descriptive observational study | 120 patients | 30% of women and 20% of men presented calcifications. |
| Loya PR et al.,(2023)[36] | Cohort study | 150 clinical records | Observed association between age and calcifications (5% increase per decade). |

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The study by Nabavi et al.[15] also supports this trend, showing a 35 % prevalence in patients over 65 years. This increase may be attributed to physiological changes in dental tissues and the accumulation of risk factors over time, such as systemic diseases and oral hygiene habits. The research by Karobari MI et al.,[26] complements this idea by reporting a constant increase in calcification prevalence over a five-year follow-up, suggesting that age is a determining factor in the progression of these conditions.

Furthermore, Giri K et al.,[28] found an overall prevalence of 29 % in an urban population, with a notable increase in older age groups. This finding is relevant as it indicates that calcification prevalence is not an isolated phenomenon but manifests across diverse populations and contexts. Variability in results may stem from differences in methodology, sample size, and studied populations.

On the other hand, the analysis by Parusheva et al.,[24] suggests that women present a higher prevalence of calcifications compared to men. This finding could be related to hormonal and metabolic factors that affect women's dental health throughout their lives. However, it is important to consider that other studies, such as that of Chaniotis A et al.,[35] report a similar prevalence between genders, suggesting that the influence of gender may vary depending on the population studied. This finding is consistent with other studies.[37]

The methodology employed in the studies also plays a crucial role in interpreting results. For example, the use of periapical radiographs in Kapetanaki et al.,[16] allowed more precise assessment of calcifications across age groups. This contrasts with studies using less specific methods, which may underestimate calcification prevalence. Standardization of diagnostic techniques is essential to obtain comparable and reliable results.

Chaniotis A et al.,[29] provide an age-group comparison reinforcing the notion that calcification prevalence increases with age. Their study found 25 % in those under 30 years, 38 % in the 30–50-year group, and 55 % in those over 50 years. This pattern is consistent with most reviewed studies and underscores the need for a preventive approach in dental care for older patients. Additionally, Signor B et al.,[27] highlight that, beyond age, other factors such as general health and dental care habits also influence calcification prevalence. This suggests that while age is a significant risk factor, other elements may also play a role.

Mishra S et al.,[25] reported a 15 % prevalence in pediatric and adolescent populations, indicating that although lower, calcifications are not absent in these groups. This suggests that dental monitoring should begin in childhood and adolescence, as calcifications can develop even in early life stages.

León-López M et al.,[31] found a 34 % prevalence in a population sample, with a significant increase in older adults. This reinforces the idea that dental care must be adapted to patients' evolving needs with age, considering the higher likelihood of calcifications in this population.

Finally, the systematic review and meta-analysis by Pietrzycka et al.,[19] reporting a global mean prevalence of 28 %, supports the findings summarized in the table. This analysis provides broader context and suggests that calcification prevalence is a common phenomenon across diverse populations, highlighting the importance of continued research in this field.

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## CONCLUSIONS

Reviewed studies demonstrate that the prevalence of root canal calcifications increases with age, reaching up to 55 % in individuals over 60 years compared to 25 % in those under 30, identifying aging as a significant risk factor. Gender differences are also observed, with higher prevalence in women (38 %) than in men (27 %), possibly linked to biological, hormonal, or behavioral factors. Clinical history also plays a role, as patients with prior endodontic treatments show a 40 % prevalence, and systemic conditions such as diabetes may increase risk—highlighting the need for a comprehensive approach that considers overall health. Finally, the radiographic technique used is decisive: digital imaging enables greater detection than conventional methods, reinforcing the importance of incorporating advanced technologies and tailored dental care.



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