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Age-related Survival of Fixed Dental Prostheses: 7 to 12 Years Retrospective Study

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Abstract

Objectives: To compare the survival rate of teeth restored with fixed dental prostheses (FDPs) between elderly and non-elderly patients. Additionally, to study the characteristics and frequency of FDP failure in both groups.

Methods: FDP data were collected from patient records treated between 2009-2013. Oral examinations and radiographs were performed, recording success and failure characteristics of the FDPs. The survival rate of FDPs in the elderly compared to the younger group was analyzed using Pearson Chi-square and Fisher's Exact Test at a 95% confidence level.

Results: Out of 155 FDPs, 136 (87.7%) survived, while 19 (12.3%) failed, with an average age of 9.1 years. In the under-60 age group, 107 of 121 FDPs (88%) survived, and 14 (12%) failed. In the elderly group, 29 of 34 FDPs (85%) survived, while 5 (15%) failed. For post-and-core with crown restorations, 20 of 23 abutments (87%) survived, and 3 (13%) failed due to root lesions and fractures.

Conclusions: The overall 7- to 12-year survival rate of FDPs was 87.7%, with no statistically significant differences between elderly (85%) and younger (88%) patients at the 95% confidence level. The incidence of caries, periodontal conditions, root lesions, and the type of restorative material also showed no significant differences between the groups.

Keywords: elderly patients, fixed dental prosthesis, survival rate

Introduction

A fixed dental prosthesis (FDP) is a type of prosthesis that is permanently attached to one or more teeth, which may be either natural teeth or dental implants, and cannot be removed by the patient.[1] FDPs include various forms such as crowns, fixed partial dentures, and post and core with crowns.

Several factors must be considered when restoring a tooth with a FDP. These include the patient's systemic disease, the extent of damage and tooth structure loss in the abutment, the abutment's position, the characteristics of neighboring teeth, the occlusal scheme, and chewing force. Treatment planning and FDP design are further influenced by patient-specific factors such as expectations, economic status, and educational background. Understanding the success and survival rates of FDPs is essential for developing effective treatment plans tailored to individual patients.

The definition of survival was FPD staying *in situ*, whether or not it was altered. The FPDs' continued *in situ* status without any issues during the whole observation period was considered success.[1] For instance, resin composites can be used to repair fractured areas, such as chipped or cracked porcelain on the substructure, particularly when the affected area is not exposed to chewing forces. Therefore, the FDP is considered to have met the criteria for survival.

Studies on the survival rate of FDPs have varied in terms of factors and limitations. Bühler *et al*.,[2] investigated the survival rate of partial ceramic crowns treated by dental students and found an 86% survival rate at 5 years post-treatment. Güncü *et al*.,[3] reported a 98.1% survival rate for zirconia-based crowns over a 5-year period. Borén *et al*.,[4] conducted a study 10 years after treatment on teeth that had undergone root canal therapy, revealing a survival rate of 81.5%, predominantly in younger patients whose teeth were restored with crowns after root canal treatment. Numerous other studies have reported varying follow-up periods, types of FDPs, survival rates, and failure characteristics.[5-11]

A systematic review by Pieger *et al*.,[12] examined the survival rate of crowns and fixed partial dentures made from lithium disilicate. The study found that after 2 years, the survival rate for crowns was 100%, while for fixed partial dentures, it was 83.3%. After 5 years, fixed partial dentures had a survival rate of 78.1%, and crowns had a rate of 97.8%. The 10-year survival rate of fixed partial dentures was 70.9%, and crowns had a survival rate of 96.7%.

The number of elderly people in the world is increasing rapidly, and advancements in medical technology have contributed to a rise in the general population's average age.[13] According to the United Nations, age groups are determined by chronological age; a "older person" is often defined as someone who is 60 or 65 years of age or older. In addition, the retirement age in Thailand is established at 60 by the government.[14] In dentistry, the rate of tooth loss among the elderly has decreased, and the use of FDPs in this population is becoming more common. This trend is driven by the desire for both comfort and aesthetics in a form that closely resembles natural teeth.[15] However, numerous studies have shown that dental caries, periodontitis, and pulp infections are more prevalent in the elderly compared to younger age groups. This is often attributed to systemic diseases that influence changes in oral conditions, as well as diminished cleaning skills, leading to poor oral hygiene.[16,17] Therefore, it is crucial to effectively treat or restore the teeth of elderly patients with FDPs to ensure that these restorations function well in their mouths for an extended period.

Only a few studies have shown that the survival rate of FDPs decreases in older patients.[4,5] Currently, there is insufficient strong evidence to suggest that elderly patients receiving FDPs face an increased risk of failure.[18] There is no definitive correlation between FDP failure characteristics and advanced age. Therefore, research on characteristics, causes, and risks of these failures is essential. This includes promoting oral health, implementing preventive measures, ensuring follow-up care, and maintaining the condition of FDPs in elderly patients. Such knowledge can significantly influence clinical decisions related to diagnosis, prognosis, and treatment planning for older individuals requiring FDPs.

The purpose of this study was to compare the 7- to 12-year survival rates of FDPs in elderly patients with those in younger age groups. Additionally, it aimed to examine the characteristics and frequency of failures to inform treatment planning for FDPs in elderly patients.

Materials and Methods

This study received ethical approval under No. 26/2020 and 27/2020 from the Human Experimentation

Committee, Faculty of Dentistry, Chiang Mai University, Thailand. Data were collected from the dental treatment records of patients who received FDPs, including crowns, posts and cores with crowns, and bridges, at the Restorative Dentistry Clinic, Faculty of Dentistry, Chiang Mai University, between 2009 and 2013. The recorded information includes the following details:

1. Patient's general information, including name, hospital number (HN), age, gender, systemic disease, and chief complaint.

2. Dental information prior to FDP treatment:

2.1 Type of occlusion: canine guidance, group function, balance occlusion, and/or occlusal interference.

2.2 Location of abutments and/or edentulous area.

2.3 Clinical findings of abutments, including the presence of carious lesions, erosion, abrasion, attrition, tooth mobility, the presence of previous restorations, and/or root canal treatment, etc.

3. Information on FDPs and radiographic findings in a cementation visit, including:

3.1 Types of retainers: full crowns, three quarter crowns, reverse three quarter crowns, and seven-eight crowns.

3.2 Materials used for restoration: full metal, all-ceramic, and porcelain fused to metal (PFM).

3.3 Types of pontics: ovade, ridge lap, modified ridge lap, conical, and sanitary.

3.4 Types of posts and cores: custom cast metal post and core, fiber-reinforced composite post and core, amalgam post and core, previous post and core, and core without post.

3.5 Type of cement for post and core cementation: polycarboxylate, zinc phosphate, and resin cement.

3.6 Type of cement for retainer cementation: polycarboxylate, zinc phosphate cement, resin cement.

3.7 Crown-to-root ratio

3.8 Cementation date of the FDPs

The inclusion criteria for research participants are: individuals who received treatment with FDPs at the Restorative Dentistry Clinic, Faculty of Dentistry, Chiang Mai University, between 2009–2013, and who consented to participate in the research. The exclusion criteria are: individuals who could not be contacted by phone or postcard, and those who did not consent to participate in the research.

The oral examinations were performed by four examiners who had undergone calibration through interpersonal testing before starting the actual assessments. For cases where characteristics were challenging to assess, a supervising examiner provided the final decision. The data were maintained consistently with the information previously obtained from the treatment records, while also recording clinical findings related to failures in teeth restored with FDPs. These findings included the number and causes of previously restored teeth loss, dislodgement of FDPs, the occurrence of secondary caries around the margins, re-infection in previously root canal-treated teeth, chipped porcelain, tooth mobility, changes in periodontal pockets, etc. Additionally, periapical and bitewing radiographs were taken to document changes for comparison with the radiographs obtained from the original treatment records.

All information was collected, and patients were classified into two groups based on their age at the time of treatment: those aged 60 years and over, and those under 60. Survival rates were analyzed using the Pearson Chi-square statistic and Fisher's exact test at a 95% confidence level.

Results

Data collected from the oral examinations of the research participants revealed a total of 155 fixed dental prostheses (FDPs), including crowns, bridges, posts, and cores with crowns. When divided into two age groups, the group younger than 60 years had 121 FDPs, while the group aged 60 years and over had 34 FDPs. Of these, 136 FDPs survived, accounting for 87.7%, while 19 FDPs failed, representing 12.3%. The average functional lifespan of the prostheses was 9.1 years. When divided into two age groups, 121 FDPs (78%) were in the group under 60 years old, and 34 FDPs (22%) were in the group aged 60 years or older.

In the group of patients under 60 years of age, ranging from 20 to 59 years, the average age was 47 years. A total of 121 FDPs were placed, with a survival rate of 88% and a failure rate of 12%. Upon examination of the abutment teeth and the FDPs in the patients' oral cavities, 89 prostheses (74%) were found to be in good condition, while 32 prostheses (26%) showed some defects. These defects were categorized as follows: 3% were treatable periodontal diseases, 2% were periodontal diseases that did not improve after treatment, 1st degree mobility was found

in 5 teeth (4%), and 2nd degree mobility in 3 teeth (3%). Additionally, 5 teeth (4%) had periapical lesions, and 6 teeth (5%) exhibited carious lesions. Among the prostheses, 5% were in poor condition but repairable, 2% required replacement with new prostheses, and 6% had been extracted. The survival rates for different types of restorations were as follows: 93% for all-metal prostheses, 100% for partial crowns, 93% for metal-ceramic prostheses, and 100% for all-ceramic crowns.

In the elderly group, aged between 60 and 81 years with an average age of 65, a total of 34 FDPs were placed, with a survival rate of 85% and a failure rate of 15%. Upon examination of the abutment teeth and FDPs in the patients' oral cavities, 23 prostheses (67%) were found to be in good condition, while 11 prostheses (33%) showed some defects. These defects included: 3% treatable periodontal diseases, 6% 1st degree tooth mobility (2 teeth), 3% periapical lesions (1 tooth), and 10% carious lesions (3 teeth). Additionally, 3% of the prostheses were in poor condition but repairable, 6% required replacement with new prostheses, and 6% had been extracted. The survival rates for different types of restorations were as follows: 94.7% for all-metal prostheses and 86.7% for metal-ceramic prostheses.

When comparing the two groups, it was found that the survival rate of FDPs was 88% in the group under 60 years of age and 85% in the elderly group. The difference in survival rates between these two groups was not statistically significant, as shown in Figure 1.

The incidence of caries in abutment teeth was 5% in the group under 60 years of age and 10% in the elderly group. The difference in caries incidence between these two groups was not statistically significant, as shown in Figure 2.

The incidence of tooth mobility in abutment teeth was as follows: in the group under 60 years of age, 4% of teeth exhibited 1st degree mobility and 3% exhibited 2nd degree mobility. In the elderly group, 6% of teeth exhibited 1st degree mobility. The differences in tooth mobility between these two groups were not statistically significant, as shown in Figure 3.

The incidence of periapical lesions in abutment teeth was 4% in the group under 60 years of age and 3% in the elderly group. The difference in the incidence of periapical lesions between these two groups was not statistically significant, as shown in Figure 4.

The types of prostheses and their survival rates in both age groups revealed that all-ceramic crowns and

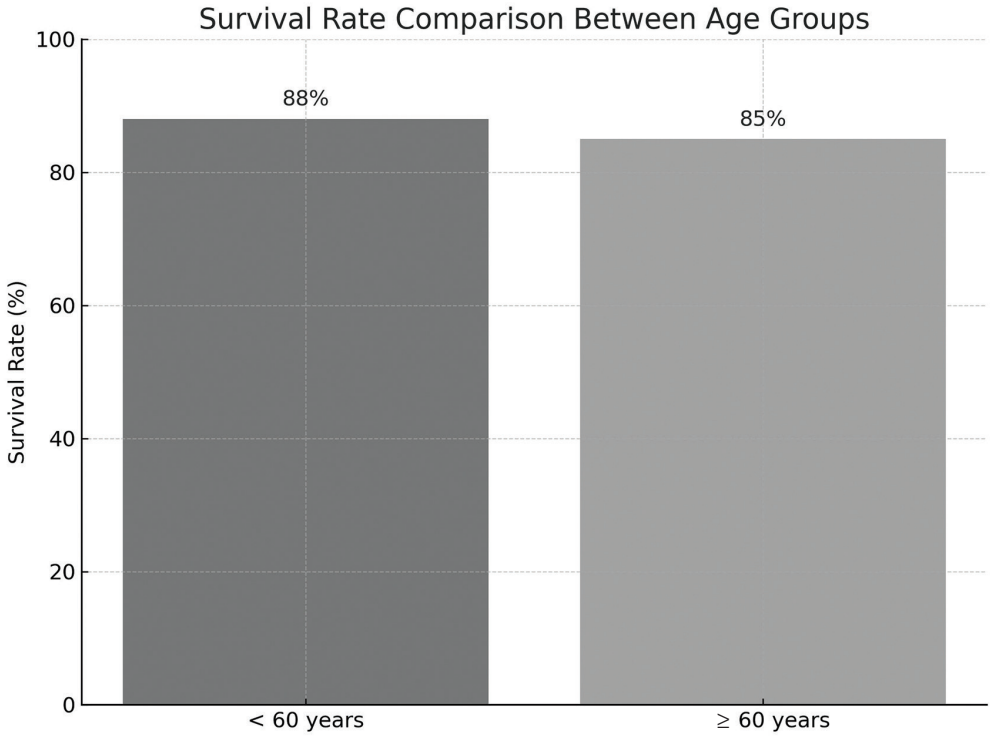

Figure 1: A chart showing a comparison of survival rates between two age groups: under than 60 years and elderly groups.

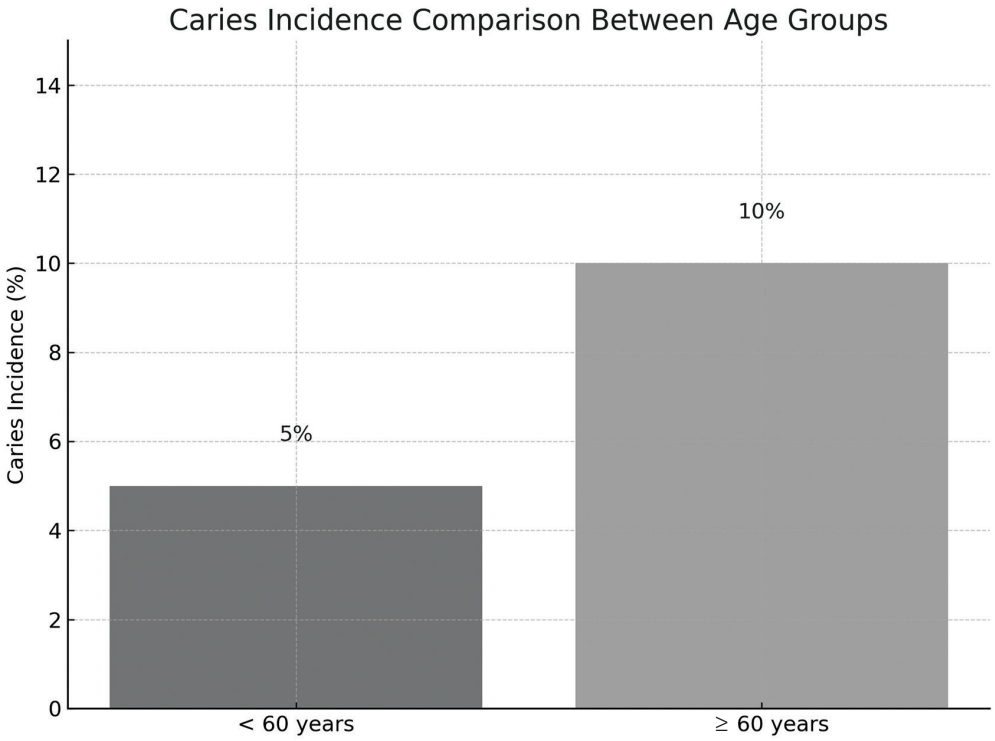

Figure 2: A chart showing a comparison of caries incidence between two age groups: under than 60 years and elderly groups.

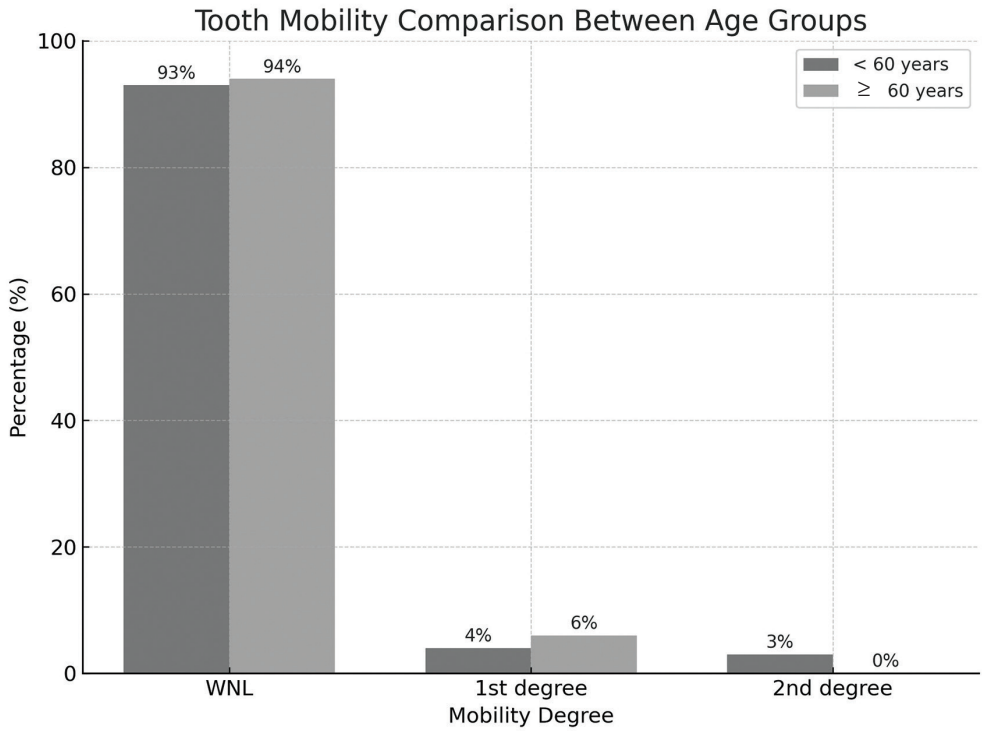

Figure 3: A chart showing a comparison of tooth mobility incidence between two age groups: under than 60 years and elderly groups.

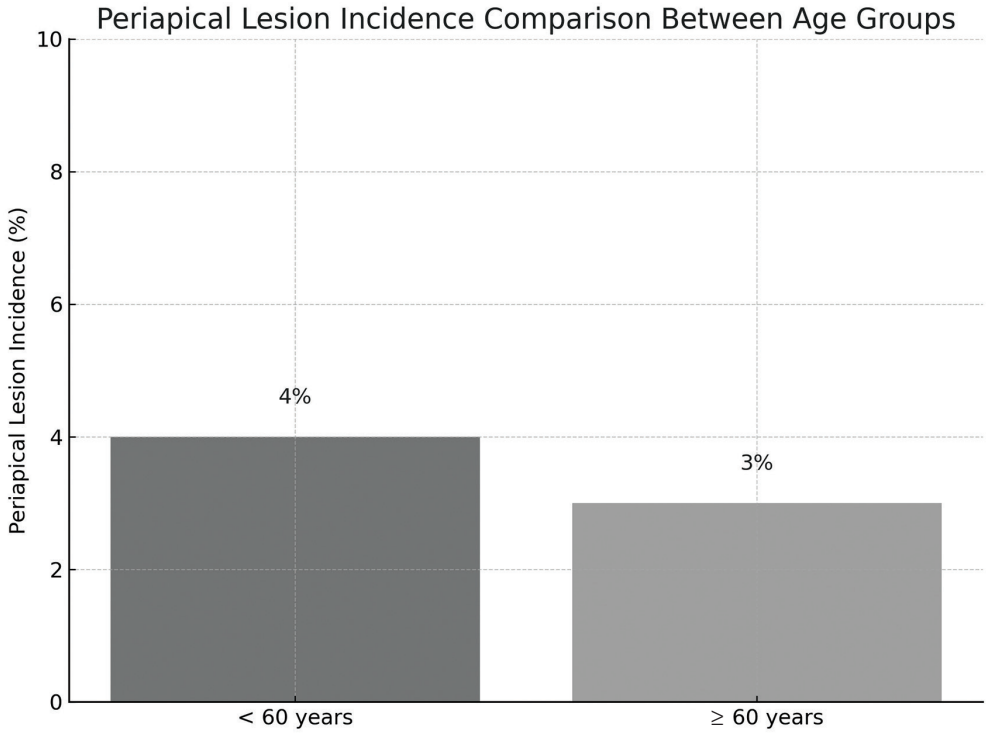

Figure 4: A chart showing a comparison of periapical lesion incidence between two age groups: under than 60 years and elderly groups.

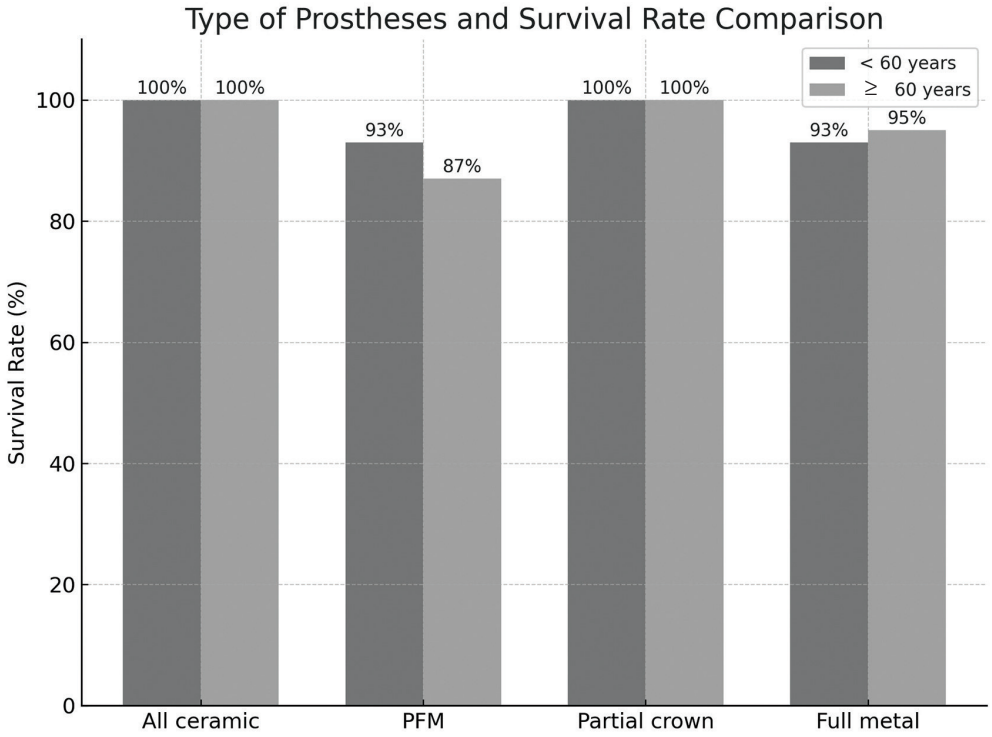

Figure 5: A chart showing a comparison of the survival rates of different types of fixed dental prosthetic materials between two age groups: under than 60 years and elderly group.

partial crowns in the group under 60 years of age had a 100% survival rate. The survival rates of metal-ceramic and all-metal prostheses did not differ significantly between the two age groups, as shown in Figure 5.

In this study, a total of 23 teeth were restored with post-and-core systems, with 78.26% in the group under 60 years old and 21.74% in the elderly group. Among these, 78.3% were metal posts, 17.4% were fiber posts, and 3.33% were amalgam posts. The survival rate for post-and-core restorations was 100% in the elderly group and 83.33% in the group under 60, with no statistically significant difference. Failures were observed in the form of periapical lesions in 2 teeth restored with metal posts and root fractures in 1 tooth restored with a fiber post.

When examining the condition of abutment teeth and restorations involving post-and-core systems with crowns, several deformities were identified: 4% of the teeth had been extracted, 9% presented with periapical lesions, 13% showed carious lesions, 13% of the restorations exhibited porcelain chipping or wear that could be repaired, and 4% had periodontal disease.

Discussion

This study found that age did not affect the survival of FDPs. Both the group under 60 years of age and the elderly group showed no statistically significant differences in survival rates (Figure 1). These findings are in agreement with the study by Loannidis *et al*.,[18] a systematic review examining the influence of patient age on the longevity of teeth supporting FDPs. Most studies in this systematic review reported that patient age had no statistically significant impact on the survival of FDPs, concluding that increased patient age should not be considered a risk factor for the survival of the FDPs. However, studies by Malament *et al*.,[19] and Palmqvist *et al*.,[20] reported higher failure rates in middle-aged patients compared to younger patients. Additionally, the study by De Backer *et al*.,[21] indicated a worse prognosis for elderly patients.

Due to the differences in the number of FDPs between the elderly group and those under 60 years of age in this study, this may have influenced the interpretation of the differences in survival rates. Additionally, a limitation of this study is the inability to specify the exact time frame for the occurrence of FDPs failure. Additionally, in this study, patients were grouped by age based on the date the FDPs were placed. Thus, even if FDP failure occurred when the patient was over 60 years old, they would still be classified in the younger age group, as the FDPs were placed when they were under 60.

Moreover, during the study, the COVID-19 pandemic occurred, which may have affected the results. Some patients may have FDPs failure, such as tooth extraction, or elderly patients may have declined to attend follow-up oral examinations, making them unable to participate in the study. This could be one of the errors the actual survival rates of the FDPs. Additionally, the variation in the number of different types of FDPs between the two age groups (Figure 5), such as the presence of partial crowns and all-ceramic crowns in the group under 60 years of age, while these FDPs were either few or absent in the elderly group, represents another limitation in interpreting the results of this study.

In the evaluation of post-and-core restorations, it was found that there was a difference in the number of patients between the two study groups. The elderly group had fewer patients, which may be one reason why failures were observed only in the group under 60 years of age. Moreover, most defects were found to be related to the crowns. The observed failures included the occurrence of periapical lesions and teeth that had been extracted due to root fractures.

The findings of this study, which showed no difference in the failure rates of FDPs between the elderly group and those under 60, may be attributed to the thorough assessment and treatment planning performed by dental students under close supervision and guidance from instructors. This approach contributes to better functionality and higher survival rates of restorations. If proper postoperative care is provided, including oral health promotion and preventive measures tailored for patients, along with regular follow-up visits to monitor the restorations and abutment teeth, the success rate can be further increased.

Conclusions

The study of all FDPs showed an overall 7- to 12-year survival rate of 87.7%, with 85% in the elderly group and 88% in the younger group. When comparing the two groups in terms of survival rates, caries incidence, periodontal conditions, periapical lesions, and types of restorative materials with prosthetic survival, no statistically significant differences were found at the 95% confidence level.

Conflicts of Interest

The authors declare no conflict of interest.

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