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Original article

A retrospective comparative ten-year study of cumulative survival rates of remaining teeth in large edentulism treated with implant-supported fixed partial dentures or removable partial dentures

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Abstract

Purpose: This study aimed to compare the survival rates of remaining teeth between implant-supported fixed dentures (IFDs) and removable partial dentures (RPDs) in patients with large edentulous cases. The second goal was to assess the risk factors for remaining tooth loss.
Materials and methods: The study subjects were selected among those who received prosthodontic treatment at Okayama University Dental Hospital for their edentulous space exceeding at least four continuous missing teeth. Twenty-one patients were included in the IFD group and 82 patients were included in the RPD group. Survival rates of remaining teeth were calculated in three subcategories: (1) whole remaining teeth, (2) adjacent teeth to intended edentulous space, and (3) opposing teeth to intended edentulous space.
Results: The ten-year cumulative survival rate of the whole remaining teeth was significantly higher in the IFD group (40.0%) than in the RPD group (24.4%). On the other hand, there was no significant difference between two groups in the survival rate of teeth adjacent or opposing to intended edentulous space. A Cox proportional hazard analysis revealed that RPD restoration and gender (male) were the significant risk factors for remaining tooth loss (whole remaining teeth).
Conclusions: These results suggest that IFD treatment can reduce the incidence of remaining tooth loss in large edentulous cases.

Keywords: Survival rate; Implant-supported fixed denture; Removal partial denture; Remaining teeth; Risk factor

1. Introduction

It is widely recognized that fixed and removable partial dentures are the most important nonsurgical prosthetic treatment options to restore patients' edentulous space. Nevertheless, these treatment modalities are also known to occasionally contribute to shorten the longevity of the abutment teeth due to mechanical overload, which is critical in large edentulous areas. For instance, fixed partial dentures (FPDs) support excessive occlusal forces that are transmitted to abutment teeth in a non-axial direction. Additionally, grinding of healthy dentine of the abutment teeth is assumed to increase the risk of caries. Regarding the removable partial dentures (RPDs), it has been reported that RPDs decrease the survival rates of teeth adjacent to the edentulous space in bounded edentulous cases and free-end edentulism [1,2]. The periodontal condition of abutment teeth is often aggravated by torqueing forces from the RPDs [3–5].

On the other hand, implant-supported fixed denture (IFD), which stands alone, has been speculated to protect teeth adjacent to the edentulous space without injuring them. However, only a few studies have evaluated the prognosis of remaining teeth in subjects treated with IFDs. This study is part of a series of reports, in which we compared IFDs, FPDs and RPDs regarding their protective effect on the remaining dentition. The previous paper focused on the survival rates of remaining teeth in bounded edentulous spaces [6]. This report

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aimed to compare the survival rates of remaining teeth between IFDs and RPDs in patients with large edentulous cases. In addition, risk factors for remaining teeth loss were also tabulated and assessed. The null hypothesis was that no significant difference in survival rates would be observed between the two treatment options.

2. Materials and methods

2.1. Study population

The intended subjects were 453 patients (IFDs: 126 patients, RPDs: 327 patients) selected among those who presented at least one remaining tooth and received IFD or RPD treatment for their edentulous space exceeding at least four continuous missing teeth in the same jaw, at the Fixed Prosthodontic Clinic of Okayama University Hospital, Okayama, Japan between April 1997 and March 2007. Exclusion criteria were those patients (1) who were installed other IFDs or RPDs except for the intended edentulous space, (2) who were scheduled an extraction of remaining tooth/teeth before IFD or RPD installation, and (3) whose data concerning the analyzed predictor variables were lacking. In response, 350 patients were excluded, and a total of 103 patients were considered as the actual sample (IFD group: 21 patients, RPD group: 82 patients). This study protocol was reviewed and approved by the Ethical Committee for Human Study of Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences (No. 213).

2.2. Primary endpoint and candidates of risk factors for remaining teeth loss

The observation period in both IFD and RPD groups started at the date of final restoration insertion and finished on March 31st, 2010. Patients' follow-up visits were scheduled at least every six months, and the treating dentist checked the status of all restorations and the periodontal condition. In addition, relining of the RPD was performed when the attending doctor judged necessary.

The primary endpoint of this study was defined as extraction or an intention/decision to extract any remaining tooth, as so described in the hospital chart. Causes for tooth extraction were classified as: caries, root fracture, periodontal, and periapical lesions. The description of each cause of tooth extraction was diagnosed based on patient's subjective complaints as well as clinical and radiographic examinations. Data were assessed twice by one investigator (S.Y.). Patients who did not return to the hospital within two years prior to the end of the study were regarded as censored cases, for whom the complication-free period was established to be from the date of final treatment completion to the last follow-up visit.

The analyzed predictor variables for the aforementioned endpoint were as follows: (1) restoration (IFD or RPD), (2) age at prosthesis insertion, (3) gender (male or female), (4) edentulous arch (maxilla or mandible), (5) edentulous pattern (bounded or free-end), (6) total number of remaining teeth, (7) number of missing teeth at the intended edentulous space, and (8) Eichner index [7]. Since the difference of occlusal supporting area could influence the prognosis of remaining teeth, Eichner index was involved in the list of predictor variables.

2.3. Identification of survival rates of remaining teeth

Survival analysis was performed to evaluate the prognosis of remaining teeth in both IFD and RPD groups. First, the cumulative survival rates were calculated by using the actuarial method to understand the tendency of all remaining teeth loss and over time transition of the actual number. Survival curves were then calculated for the remaining teeth in three different subcategories: (1) whole remaining teeth, (2) adjacent teeth to intended edentulous space, and (3) opposing teeth to intended edentulous space. If there happened an incidence of tooth loss in one subcategory, observation of all categories was also finished. Furthermore, the causes for tooth loss were classified into the following four categories: (1) root fracture, (2) caries, (3) periodontal, and (4) periapical lesions. Diagnoses of these conditions were based on patient's subjective complaints as well as clinical and radiographic examinations.

2.4. Statistical analysis

Chi-square test and *t*-test were used to compare baseline data between IFD and RPD groups regarding age at prosthesis insertion, gender, functional duration of prosthesis, missing unit, missing pattern, remaining teeth number, missing teeth number at intended edentulous space, and Eichner index. Survival curves were calculated by Kaplan–Meier analysis [8]. The log-rank test was used to compare the survival curves between two groups [9]. Finally, the Cox proportional hazards regression model [10] was performed with all analyzed predictor variables simultaneously, in order to identify the significant risk factors for remaining tooth loss in both IFD and RPD groups. This analysis was also performed for each of the three aforementioned subcategories of remaining teeth (whole remaining teeth, adjacent and opposing teeth to edentulous space). Data analysis was performed with StatView ver5.0 for Windows statistical software package (SAS Institute Inc., Cary, NC, USA), and the level of statistical significance was set at $p < 0.05$.

3. Results

3.1. Baseline data

As shown in Table 1, baseline data comparison revealed a significant difference between IFD and RPD groups in regard to the mean age at prosthesis insertion (IFD group: 46.4+/−15.0 years, RPD group: 60.6+/−12.7 years; $p < 0.001$), and gender (male/female: 15/6 for IFD group, 35/47 for RPD group; $p = 0.02$).