Original Research

Use of Magnetic Attachments in Dentures : Analysis of an 8-year Longitudinal Study

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Clinical significance

In this study, the survival and longevity of dentures and the abutment teeth associated with the use of magnetic attachments are summarized, based on data collected over an 8-year period. These results will provide useful data to evaluate the prognosis of dentures with magnetic attachments.

ABSTRACT

Purpose : Magnetic attachments are available for various prosthodontic applications. However, several problems have been noted over the past few years as their use has increased. In this study, the challenges associated with magnetic attachments in prosthodontics are summarized, based on data collected over an 8-year period.

Materials and Methods : Seventy-seven patients with overdentures and magnetic attachments were observed from November 1992 to August 2000 at Osaka Dental University Hospital. The relationship between the occurrence of problems and time was analyzed through the use of the Kaplan-Meier survival analysis. The prognostic factors were classified into two categories : complete vs. partial dentures, and conventional dentures vs. dentures for resected jaws, which were compared using the Log rank test at a significance level of 0.05.

Results : Problems were noted for 37.1% of the abutment teeth and 30.6% of denture bases. The overdentures placed in cases where jaws had been resected for tumor removal performed significantly worse than conventional overdentures.

Conclusion : Magnetic attachments might help to improve denture retention, except for cases where jaws have been resected.

Key words

magnetic attachment, survival rate, denture, prognosis

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INTRODUCTION

In recent years, the size of magnets has been reduced considerably without compromising retention, which makes magnetic attachments more effective for dental applications. Magnetic attachments, such as Magfit (600, 600 s, 400 EX, 600 EX, 400 W and 600 W), Magsoft (S, L), and Magnedisc (500, 800) (Aichi Steel, Tokai, Japan), are available for various prosthodontic procedures^{1,2)}. We previously reported on the clinical use of magnetic attachments and their influence on periodontal tissues³⁾. However, we have noted several problems over the past few years as their use has increased, including difficulties related to adhesion to the denture base or compromised abutment teeth. In this study, the relationship between the occurrence of problems and time was evaluated through the use of Kaplan-Meier survival analysis.

MATERIALS AND METHODS

Seventy-seven patients receiving overdentures with magnetic attachments at Osaka Dental University Hospital from November 1992 to August 2000 were included in the analysis. The attachments used were Magfit, Magsoft and Magnedisc (Aichi Steel, Tokai, Japan). The population comprised 30 male and 47 female patients with a mean age of 66.2 (SD $\pm$ 8.9). Overall, 74 conventional overdenture bases were included in the analysis, along with 11 overdentures for jaws resected after tumor removal. Of these overdentures, 55 were newly fabricated, and 30 were repaired dentures. The repaired dentures were fitted with a magnetic attachment when there was a problem noted with an abutment or any tooth of an existing denture without magnetic attachments. There were 116 abutment teeth in all. Data were collected from the

clinical records of patients seen from November 1992 to November 2000. When the abutment and/or dentures had problems during the observation period, the problems were remedied, if possible, to allow patients to continue to use them.

The relationship between the occurrence of problems and time was determined using the Kaplan-Meier survival method (SPSS® Advanced Models 10.0 E, SPSS Inc., Chicago, Illinois, USA)⁴⁾. This method permits the use of all data, even when the duration of the observation period differs. The survival probability at a certain point in time is estimated by the cumulative survival probabilities obtained for the prior periods.

In this study, the endpoint was defined as the time when problems occurred with the dentures having magnetic attachments or with the abutment teeth. We decided to base the endpoints on two patterns of problems : 1) The point in time at which problems initially occurred (ENDPOINT 1) for dentures with magnetic attachments (fracture of the denture, or magnet separation) or for abutment teeth (keeper separation, caries, extraction, or tooth loss due to natural causes). When difficulties were encountered with abutment teeth or dentures, they were rectified as much as possible so that the dentures could be used to some extent ; and 2) The point in time at which magnetic attachment functionality was lost (ENDPOINT 2).

The prognostic factors were classified into two categories, which were compared using the Log-rank test at a significance level of 0.05. The paired categories were complete type vs. partial type dentures, and conventional dentures vs. dentures for resected jaws.

RESULTS

Problems with Abutment Teeth and Dentures with Magnetic Attachments

Figure 1 shows the results of the analysis of the initial problems with the abutment teeth. Overall, 37.1% of the abutments had problems : 15.6% of the teeth were extracted, 11.2% had lost the keeper, 8.6% of the teeth were lost

Fig. 1 Problems associated with abutment teeth
Breakdown (percent) of the initial problems of the total number of abutment teeth

through circumstances other than extraction, and 1.7% became carious. In the case of the denture bases, 30.6% were problematic : 21.2% fractured, and 9.4% underwent separation of the magnet (Fig. 2).

Survival Analysis

1. ENDPOINT 1

Figure 3 illustrates the survival curve for the denture bases. The duration of the observation ranged from 0.5 to 86.6 months, with a mean

Fig. 2 Problems associated with dentures
Breakdown (percent) of initial problems of total dentures

Fig. 3 Kaplan Meier curve for survival of dentures with magnetic attachments (ENDPOINT 1)

Fig. 4 Kaplan-Meier curve for survival of abutment teeth with magnetic attachments (ENDPOINT 1)

Fig. 5 Kaplan-Meier curve for survival of dentures with magnetic attachments (ENDPOINT 2)

observation period of 25.2 months. The cumulative survival rate at the end of the observation period was 57.2%, and the mean survival time was 59.9 months. The survival declined until 40 months, at which point it leveled off.

In the case of the abutment teeth, the duration of observation was 2.1 to 85.3 months, with a mean observation period of 38.9 months. The survival rate decreased at 71 months and reached zero at 85.3 months (Fig. 4). The mean survival time was 64.8 months.

2. ENDPOINT 2

The survival curve for the denture bases is shown in Fig. 5. The duration of the observation period was 0.9 to 86.6 months, with a mean observation period of 29.4 months. The survival rate at the end of the observation period was 97.1%, and the mean survival time was 84.3 months. In the case of the abutment teeth, the duration of observation was 2.1 to 86.6 months, with a mean value of 39.0 months. The final survival rate was 5.6% (Fig. 6), and the mean survival time was 70.3 months.

Fig. 6 Kaplan-Meier curve for survival of abutment teeth with magnetic attachments (ENDPOINT 2)

Fig. 7 Kaplan-Meier survival curves : Comparison of conventional dentures vs. dentures for resected jaws (ENDPOINT : missing teeth)

Determination of Prognosis

The mean survival times of the complete and partial dentures were 67.7 and 53.4 months, respectively. However, results of the Log rank test revealed no significant difference between the complete and partial dentures ($p=0.0890$).

There was a significant difference between the conventional overdentures and the overdentures used for resected jaws. Figure 7 shows

the Kaplan-Meier curve at the endpoint that was due to either extraction or tooth loss from natural causes ($p=0.0066$). Figure 8 displays the data for the endpoint having either magnet separation or denture fracture as the initial problem ($p=0.0122$). The conventional overdentures had a significantly longer survival time than the overdentures for resected jaws.

Fig. 8 Kaplan-Meier survival curves : Comparison of conventional dentures vs. dentures for resected jaws (ENDPOINT : loss of magnet, denture fracture)

DISCUSSION

In this study, the initial problems with dentures were likely to occur within 40 months (about 3 years) after service began, which was earlier than in a previous report where the rate of denture fracture was the highest after 4.5–5.5 years of use⁵. In the case of dentures with magnetic attachments, the area where the magnet adheres is the thinnest part of the denture and is thus more prone to fracture. In this study, the denture generally fractured around the magnets. The survival rate at the end of the observation period (97.1%) for ENDPOINT 2 was higher than for ENDPOINT 1 (57.2%). When problems occurred with abutment teeth or dentures at ENDPOINT 1, they were rectified as much as possible so that the dentures could be used, suggesting that magnetic attachments are easy to repair or to remedy. The survival rate of the abutment teeth reached zero after about 7 years. According to Fletcher et al⁴., the number of patients on whom survival estimates are based often becomes relatively small as time progresses because of deaths, dropouts, and late entrance

into the study, resulting in fewer patients being followed for the complete duration of the study. As a result, estimates of survival toward the end of the follow-up period are less precise and can be greatly affected by events occurring to a relatively small number of patients. Even though the problems related to faulty abutments occurred in only 38% of the cases in our investigation, the survival rate reached zero by the end of the observation period. This finding was due to the fact that most of the problems occurred in those cases having the longest duration.

When keeper separation was observed, it was repaired and subsequently functioned well. However, there was little difference in terms of the final survival rate between ENDPOINT 1 and ENDPOINT 2 because more than half of the problems resulted in extraction and natural tooth loss.

The conventional overdentures had a significantly longer survival time than the overdentures for resected jaws. These latter dentures often lacked adequate retention, support and stability due to defects in the alveolar ridge or jaw bone⁶. The overdentures for resected jaws tended to have more problems compared to the conven-

tional dentures, especially because of the condition of the abutment teeth, which may have lost bone support or been subject to caries following radiotherapy. This area will require further investigation.

Overall, the results of this study suggested that there was not a relationship between the prognosis of magnetic attachments and the type of denture. However, deficiencies in the residual ridge indicated a poorer prognosis.

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