Mortality Patterns in Partially Edentulous and Edentulous Elderly Patients Treated with Dental Implants

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An association between oral health, number of teeth, and mortality has been reported in the literature, but limited knowledge is available on mortality in elderly partially edentulous and edentulous patients treated with implants. ***Purpose:*** The aim of this retrospective study was to compare the mortality pattern in elderly patients (80 years or older) who were provided with implants and were partially or completely edentulous. ***Materials and Methods:*** Between 1986 and 2003, a total of 266 elderly patients with a mean age of 83.0 years at the time of implant placement were included. The patients were provided with 1,384 Brånemark System implants (Nobel Biocare) in 285 arches. The sample was divided into two subgroups: 108 edentulous patients and 158 partially edentulous patients. Information was collected for each individual regarding expected remaining lifetime at the time of implant surgery. Cumulative survival rate (CSR) was calculated and compared for the two subgroups covering 10 years and was also compared to expected CSR data for normal populations of comparable distribution. ***Results:*** Mortality was significantly decreased ($P < .05$) for partially edentulous compared with edentulous patients (–10.4%) after 10 years of follow-up. CSR for the elderly groups showed a significant decrease in mortality compared with comparable groups of normal populations ($P < .05$). There was no significant difference in morality between healthy/nonhealthy patients at first surgery or patients with reported/unreported implant failures ($P > .05$). ***Conclusions:*** Elderly partially edentulous patients had significantly lower mortality compared with edentulous patients over a 10-year period of follow-up. Both subgroups also showed significantly lower mortality compared with normal populations of comparable sex and age at the time of implant surgery. The observation is interpreted as that these patients are healthier and more motivated to replace their lost teeth with implants than the normal population rather than that implant treatment per se reduces mortality. *Int J Prosthodont 2014;27:250–256. doi: 10.11607/ijp.3780*

An association between general and oral health has been suggested in several publications where, eg, the risk for Alzheimer disease or dementia appears to increase in patients with reduced numbers of remaining teeth.[1–3] A reduced number of remaining teeth has also been shown to be associated with increased mortality.[4–10] Accordingly, Österberg et al[5] suggested as a conclusion in one of their studies: "Number of teeth is a significant predictor of 7-year mortality in 75-year-old women independently of a number of factors related to lifestyle, disease, and reduced functional capacity." However, whether tooth loss is a causality factor for increased mortality or is another sign of compromised general health is certainly an open question, and no available study has tested if tooth replacement may be protective against increased mortality.[10] Accordingly, it is not known if rehabilitation of missing teeth to improve social well-being, masticatory efficiency, and diet may have an effect per se on mortality.[10]

Increases in longevity and Western society's elderly patient cohort suggest an increasing number of patients who may lose their teeth and eventually become edentulous.[11,12] Several of these patients are treated with implants, but reported results of implant

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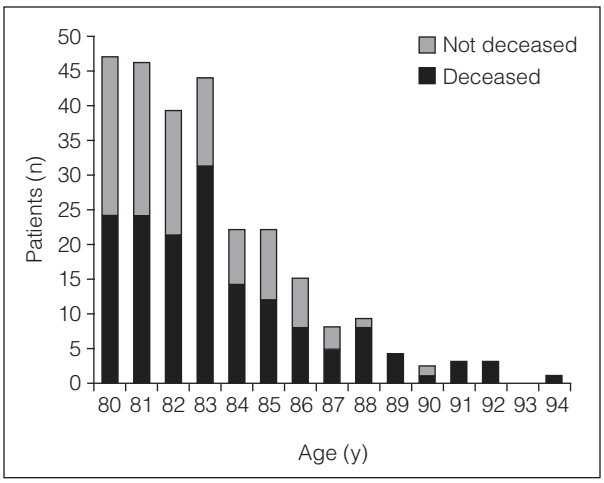


Fig 1 Distribution and number of included patients with regard to age at first surgery and deceased/not deceased after 10 years of follow-up.

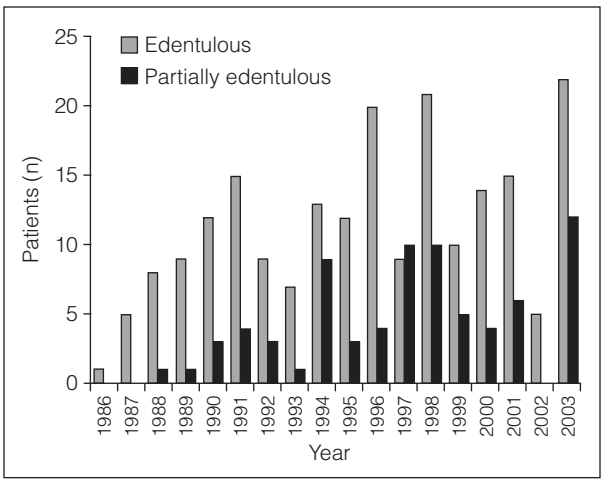


Fig 2 Distribution and number of edentulous and partially edentulous patients with regard to year of implant surgery.

treatment outcomes in elderly patients appear contradictory.[13–18] A recent report by Friberg and Jemt[19] observed that elderly edentulous patients restored with implants in the mandible presented with fewer complete failures or severe bone loss compared with younger patients. They also showed that younger edentulous patients presented a higher mortality rate than normal populations of comparable age.[19]

The aim of this retrospective study was to compare life tables in implant-treated partially and completely edentulous elderly patients (> 80 years) with those of untreated populations of comparable age. The hypothesis was that partially edentulous patients present a lower mortality rate than completely edentulous patients.

Materials and Methods

This retrospective follow-up study was approved by the local Ethics Committee in Gothenburg and carried out on a group of previously described[17,18] elderly patients who were 80 years or older. They were consecutively selected from patients treated at one clinic (The Brånemark Clinic, Public Dental Health Service, Gothenburg, Sweden) from January 1986 to December 2003. The patients were either provided with implant-supported prostheses in the partially edentulous arch (partially edentulous group) or provided with implants in one or both edentulous arches (edentulous group). Patients treated with implants in combination with major bone grafting procedures were excluded, as were patients who underwent implant surgery at the clinic but had prosthetic treatment performed and followed-up by the referring clinician.

Table 1 Distribution of Patients at Time of Implant Surgery

	Edentulous	Partially edentulous	Total
Patients	158	108	266
Mean age y (SD)	82.7 (2.56)	83.4 (3.23)	83.0 (2.86)
Women	92	69	161
Men	66	39	105
Healthy	70	66	136
Implants	747	546	1293

Patients

A total 5,857 patients were treated with a total of 29,230 implants at the clinic during the inclusion period (1986 to 2003). Altogether, 266 patients (4.5%) were 80 years or older at the time of implant surgery (elderly group). These patients were treated in 285 arches with 1,384 Brånemark System implants (Nobel Biocare) (Table 1 and Figs 1 and 2). One-hundred eight of the patients were partially edentulous (partially edentulous group), with a mean age at implant placement surgery of 83.4 years (SD: 3.23; range: 80 to 95 years). The edentulous group was composed of 158 patients with a mean age of 82.7 years (SD: 2.56 years; range: 80 to 93 years). More women (61%) than men were included in both patient groups (Table 1).

One hundred thirty-six of the included patients (51%) reported no ongoing medication and presented with good general health at the time of implant surgery (Table 1). Records with regard to smoking habits were available for 233 patients (88%) and indicated that 23 patients (9%) were smokers.

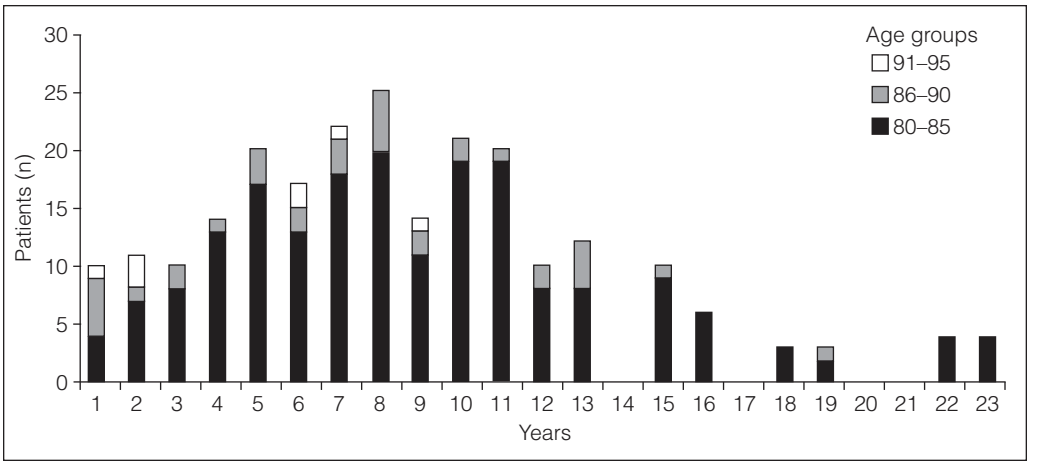


Fig 3 Distribution of deceased patients during follow-up with regard to years of survival after implant surgery in different age groups at inclusion.

Treatment of the patients is presented in more detail in previous publications.[17,18,20] In brief, Brånemark System implants (Nobel Biocare) were placed, in most cases, following a two-stage surgical protocol.[20] After abutment connection, the patients were provided with fixed screw-retained prostheses with cast frameworks in gold alloy (partially edentulous and edentulous)[21] or titanium premachined and welded[22,23] or CAD/CAM frameworks[24] (only edentulous). The veneering material was porcelain (partially edentulous) or artificial resin (early partially edentulous and all edentulous) for the two framework designs, respectively.[25]

After prosthesis placement, all patients were invited to participate in a routine follow-up program of implant treatment according to a standardized clinical and radiographic protocol. Clinical examinations were scheduled on a routine basis for all patients after 1 and 5 years and then every 5 years in function.[25] Patients were also recalled for closer checkups on an individual basis if indicated, but all patients were encouraged to contact the clinic themselves for extra examinations whenever a problem occurred.

Registrations

Data were retrospectively retrieved from the patients' records, where focus in the present study was age and general health at implant surgery, sex, arch treated, dentition in opposing arch, implant failures, and time of last clinical and radiographic follow-up examination.

Data on timepoint when the present patients were deceased was continuously collected from the official population database ("Västfolket"). This information was used to calculate the cumulative survival rate (study group CSR) for the total group and the two subgroups covering 10 years of follow-up.

Furthermore, information was collected for each individual patient regarding expected remaining lifetime at the time of implant surgery from life tables of the Swedish population.[26–29] These data covered sex, age at implant surgery, and time period of implant surgery (1986 to 2003). Based on these data for individual patients, an expected mean CSR was calculated for a normal population group of comparable age at first surgery (population CSR). Thereafter, calculated CSR data for the study groups and normal populations were compared.

Statistics

Conventional descriptive statistics (mean, SD, CSR) were used for the present material. Statistical comparisons between CSR were performed by use of a log rank test. All tests were performed on patient level, and statistical significance was set to 5%.

Results

Patients Lost to Follow-up

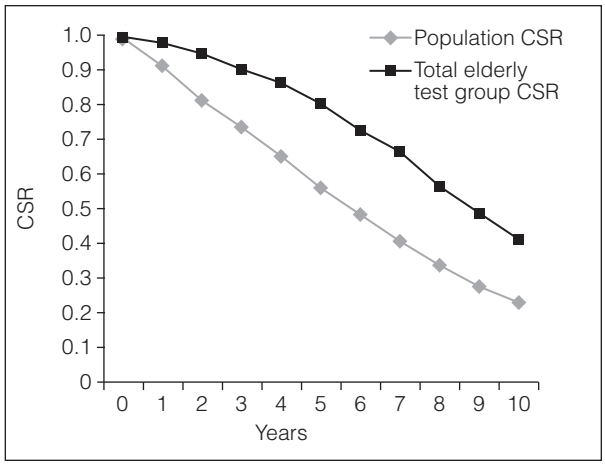
It was possible to track all treated patients in the population data base "Västfolket" and, accordingly, no patient was lost to follow-up with regard to lifetime observations.

Pattern of Survival

Mean survival time of patients at the termination of the study (also including patients still alive) was > 8.9 years (SD, 4.19) and > 8.5 years (SD, 4.52), respectively.

Altogether, 230 patients were deceased (Fig 3), but 36 patients (24 women) were still alive, presenting a mean age at the first surgical intervention of 82.4 years (SD, 1.98), with an age range from 80 to 87 years.

Fig 4 Cumulative survival rate (CSR) of total group of included patients in relation to corresponding normal population (population CSR).



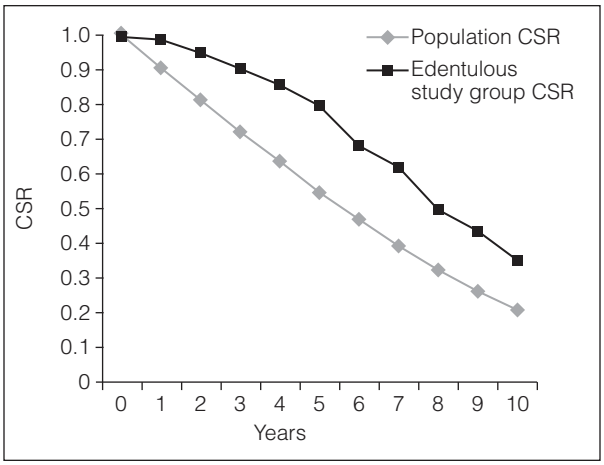


Fig 5a Cumulative survival rate (CSR) of included edentulous patients in relation to corresponding normal population (Population CSR).

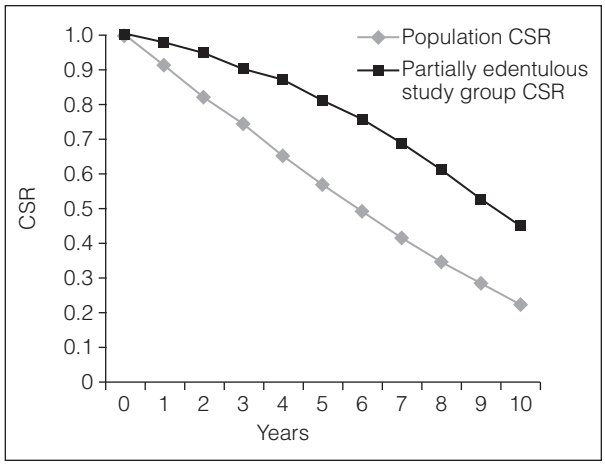


Fig 5b Cumulative survival rate (CSR) of included partially edentulous patients in relation to corresponding normal population (Population CSR).

Twenty-four of these surviving patients were treated in partially edentulous arches, and the remaining 12 patients were treated in edentulous arches.

The CSR for the total and two subgroups of patients during the first 10 years of follow-up after first implant surgery are presented in Figs 4 and 5. The mortality was significantly decreased ($P < .05$) for partially edentulous as compared to edentulous patients (–10.4%) after 10 years of follow-up. It can also be noted that the total group (–19.2%), as well as the edentulous (–14.0%) and partially edentulous (–22.7%) groups, showed significantly decreased mortality compared with comparable groups of normal populations ($P < .05$).

The difference between the CSR for edentulous and partially edentulous patients and expected CSR for the corresponding normal population is presented in Fig 6. It can be observed that there is a consistently increasing difference for the first 5 years of follow-up, followed by a reduced difference up to 10 years after implant surgery (Fig 6).

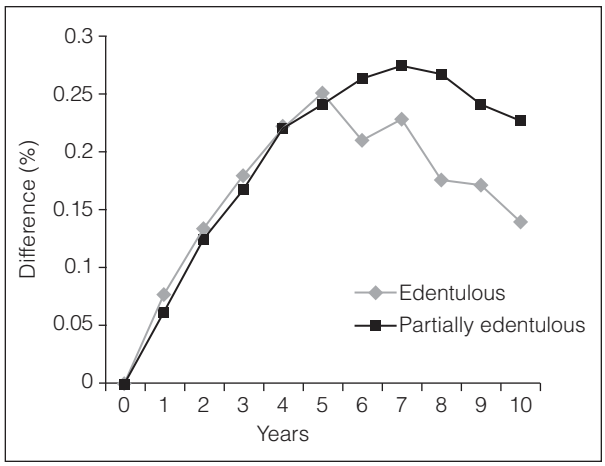


Fig 6 Difference between expected CSR for the corresponding normal populations and CSR for edentulous and partially edentulous patients during 10 years of follow-up.

There were no significant differences for CSR between patients recorded as healthy and those with more or less compromised general health status at the time of implant placement ($P > .05$). Furthermore, there was no difference in mortality between patients with reported implant failures (7.1%) and those with no failures reported during follow-up.

Discussion

The present study shows a clear association between partially edentulous and edentulous patients and mortality in the elderly population, as reported in other publications[5–10,30,31] and suggests that partially edentulous elderly implant patients present a significantly reduced mortality when compared with edentulous elderly implant patients. Health, socioeconomics, and lifestyle aspects were not considered in this study, although Österberg et al suggested in an earlier report that these factors are not associated with differences in mortality.[4,5] Polzer et al[10] identify biologic mechanisms that may be associated with numbers of teeth present and mortality, such as inflammation/infection and diet/nutrition. Psychosocial aspects and feeling of well-being for edentulous persons may also be important, since relationships between mental stress and the immune system (inflammation) could also be considered. It seems appropriate to discuss the possibility that this difference in mortality between partially edentulous and edentulous patients may be the result of teeth providing protection against mortality, since partially edentulous patients do have a higher masticatory efficiency and better diet.[32–34] An alternative consideration, of course, is that loss of teeth just reflects another side of a more compromised general health situation.[35]

Even though it is reasonable to assume that edentulism reflects a more compromised general health situation, it could also be speculated that implant treatment may have a positive impact on mortality. If that is the case, it could be observed as a trend of an immediate response within a very short period of time from treatment or as a reduction of mortality compared with the normal population (Fig 6). This positive impact could then be suggested to last for approximately 5 years before the positive trend in mortality between implant treatment and normal populations starts to decrease again (Fig 6). Alternatively, the trend of immediate improvement in mortality between treated and normal populations (Fig 6) may also suggest that the difference in risk between the populations existed before, rather than being initiated by the treatment.

The authors' data also show that elderly implant patients have a significantly lower mortality than expected in the normal population ($P < .05$, Fig 5), which suggests an underlying difference between elderly treated and untreated (normal) patients at the time of implant surgery. Here too, data on socioeconomic or lifestyle factors are unavailable in the present study; however, this observation could be related to the fact that the present group of elderly patients, in need of tooth replacement, are healthier and more motivated for treatment than other elderly patients who are also missing several or all teeth. It could also be assumed that the present elderly implant patients were recruited from a healthier part of the elderly population. Friberg and Jemt[19] have reported a similarly significant difference in mortality between older edentulous patients provided with implants and the normal population as observed in the present study. However, they also reported an opposite pattern of increased mortality in a treated group of younger edentulous patients compared with the normal population. They suggested that the difference in pattern between older and younger edentulous implant patients was also related to the fact that the patients were recruited from different subgroups of patients with regard to general health, where younger patients had higher risks related to general health compared with the normal population. On the other hand, the older group of edentulous implant patients were advised to be recruited from a healthier subgroup of older patients, as also suggested for the patients in the present study. In their conclusion, they suggested that younger edentulous patients may present a higher risk for implant complications during maintenance compared with elderly patient groups.[19]

In the present study, it could be assumed that patients with a more compromised health situation at first surgery would have presented a higher mortality than "healthy" patients at first surgery during 10 years of follow-up. However, there were no indications in the present material that health at surgery had any impact on elderly patient mortality over a 10-year period of time. This lack of difference in mortality between healthy and nonhealthy patients at surgery may be due to an exceedingly lengthy time span of follow-up after the first surgery and that health problems may arise later or be caused by the fact that medication prolongs lifetime.

The inherent limitations in this type of study's research design are readily acknowledged, since there are so many biologic, social, and financial factors (left uncontrolled in this and similar articles) that are likely to be far more proximate to mortality than implant treatment. However, it is not implant treatment per se that is the focus of this study, but the possible difference in general health between treated patients with and without teeth as well as possible differences between

treated elderly patients and patients not requesting implant treatment. Nonetheless, the nature of retrospective studies may figure prominently in the search for causal links, which may in turn prove useful in the formulation of hypotheses that may then be tested in prospective randomized or cohort trials. It is with this objective in mind that the present data were collated and presented, while the authors acknowledge the clear need for a more focused examination of those factors that correlate with diverse dental treatments and mortality.

Conclusion

This study showed that elderly partially edentulous patients had a significantly lower mortality compared with edentulous patients, over a 10-year follow-up period. It also showed that elderly implant patients had a significantly lower mortality compared with a normal population of comparable age and sex, possibly due to the fact that elderly implant patients were recruited from a subgroup of older partially edentulous/edentulous patients with better health than the normal population. Consequently, the observed reduced mortality in the present elderly group of implant patients is interpreted as an association between a healthier patient cohort that is more motivated to replace their lost teeth with implants than the untreated one (including the less healthy segment), rather than an interpretation that implant treatment per se reduces mortality.

Acknowledgments

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Literature Abstract

Oral bisphosphonate-related osteonecrosis of the jaws in dental implant patients: A case series

The authors retrospectively reviewed cases of dental implant patients who had taken oral bisphosphonates and subsequently developed bisphosphonate-related osteonecrosis of the jaw (BRONJ) within the previous 3 years. Patient records from three hospitals in Galicia, Spain, revealed nine white patients (eight women, one man; mean age 66 years) fitting the description, together having 57 (28 maxillary and 29 mandibular) dental implants. The most common reason for taking bisphosphonates was osteoporosis (n = 7). The mean interval between the commencement of bisphosphonate treatment and the onset of BRONJ was 60 months. The average time between dental implant placement and onset of BRONJ was 34 months (range, 1 to 96 months). Most lesions were located around mandibular implants (n = 8). Seven of nine patients recovered completely after treatment. The authors commented that the limited number of subjects did not allow them to assess the contribution of coexisting conditions such as systemic hypertension, corticosteroid medication, or smoking as predisposing factors. The authors admitted that data on the prevalence of BRONJ were not available but suggested that the prevalence could be higher than expected. They added that the clinical characteristics of BRONJ lesions and their treatment outcomes were similar to those observed in patients without dental implants.

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