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# **The prevalence of dental implants and related factors in patients with Sjögren's syndrome: results from a cohort study**

Katinka Albrecht, Johanna Callhoff, Gisela Westhoff†, Thomas Dietrich, Thomas Dörner, Angela Zink

## **Abstract**

**Objective:** To investigate prevalence and patient-reported outcomes of dental implants in patients with Sjögren's syndrome (SS).

**Methods:** A total of 205 female patients from an observational cohort study answered oral health questionnaires about periodontal signs and symptoms, dentures, dental implants, comorbidities and therapies that may interfere with bone remodeling. Data were compared with the reports of 87 female healthy controls.

**Results:** The patients were younger than the controls ( $58 \pm 12$  and  $54 \pm 14$  years, respectively) and differed substantially in the prevalence of self-reported gingivitis (46 and 21%), self-reported periodontitis (19 and 8%) and in the numbers of remaining teeth ( $21 \pm 7$  and  $24 \pm 5$  teeth). Patients more frequently had removable prostheses (30% compared to 21%) and dental implants (16% compared to 7%). The 32 SS patients with dental implants had a mean number of  $3.3 \pm 2.0$  implants. Notably, for patients with implants, their oldest existing implant survived for a mean period of  $4.9 \pm 5.4$  years. A total of 5 of 104 (4.8%) implants in the patients and none of the 14 implants in the controls had to be removed. A total of 75% of the patients were highly satisfied with the implants and 97% would recommend them to other SS patients.

**Conclusion:** A substantial portion of patients with SS have dental complications and require subsequent implants. The majority were satisfied with the implants and would recommend them to other patients. The high implant survival rate may encourage

patients, rheumatologists and dentists to consider dental implants for the treatment of SS patients.

**Key Indexing Terms:** Sjögren's syndrome, epidemiology, patient-reported outcomes, dental implants

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**Running footline:** Dental implants in Sjögren's syndrome

## Introduction

Primary and secondary Sjögren's syndromes (SS) are systemic disorders characterized by lymphocyte infiltration and progressive destruction of exocrine glands leading to mucosal dryness, particularly of the eyes and mouth. The disease not only decreases saliva production but also alters the protein profile and the composition of saliva. Saliva has an active protective role in maintaining oral health under normal conditions (1). Saliva preserves the oral cavity through its lubricating function, which protects the soft tissues from desiccation, penetration or ulceration (1-4). It also stimulates soft tissue repair by reducing clotting time and accelerating wound contraction. Furthermore, it contains numerous antibacterial, antiviral and antifungal agents which modulate the oral microbial flora (3-5).

Because of its proteins, glycoproteins, enzymes, electrolytes, and small organic molecules, saliva preserves oral homeostasis and promotes the remineralization of teeth (5;6). The disturbance of this homeostasis in patients with SS results in an increased risk of dental caries and tooth loss (6-8). Due to this susceptibility, patients with SS frequently require dentures early in their lives. However, these patients are confronted with extraordinary difficulties when wearing removable dentures because mucosal dryness increases the risk of soreness in denture-bearing tissues, reduced retention of dentures and other complications, such as local candida infections.

Implant-supported prostheses may offer a solution to ameliorate several of these prosthodontic complications in patients with SS. However, systemic conditions, such as rheumatoid arthritis, osteoporosis, diabetes mellitus or hyperthyroidism, as well as immunosuppressive therapies, have been regarded as risk factors for osseointegration, although the degree of systemic disease-‘control’ may be more important than the disorder itself (9). In many of these patients, quality of life and

functional benefits from dental implants may outweigh the risks (9). In a literature review focusing on implant survival in subjects diagnosed with systemic diseases that are regarded as possible contraindications, only case series were reported that compared patients with and without the condition in controlled settings (10;11). A recent cohort study and several case reports and case series on dental implants in patients with SS already indicate the feasibility of implant therapy for SS patients (11-16).

The aim of the present study was to evaluate the prevalence of dental implants in a large sample of patients with SS and to gauge the patients' experience with dental implant therapy compared with healthy control subjects.

## **Methods**

The data of females with SS from an observational prospective cohort study in Germany were used. Enrolment with annual follow-up was initiated in 2009 in four specialized rheumatologic centers in Germany that were participating in a collaborative project promoted by the European League Against Rheumatism (EULAR) to develop consensus disease activity indices (17). Patients were diagnosed with primary or secondary SS according to the European American Consensus Group criteria (18). Controls were patients' female friends of approximately the same age ( $\pm 3$  years) who were not suffering from dry eyes or dry mouth. Details regarding recruitment and annual follow-ups have been described elsewhere (17).

All patients enrolled in the cohort until February 2012 were asked to complete an oral health questionnaire to ascertain oral problems and provision with dental prostheses.

The questionnaire assessed previous and current dental and periodontal signs and symptoms, such as toothache, caries, bleeding of the gums, gingivitis and periodontitis; these assessments were further categorized in relation to time (since childhood, adolescence or adulthood) and frequency (not at all/once/sometimes/frequently during the past 12 months/no more or more frequently than others). The signs of gingivitis and periodontitis were explained and illustrated. The patients also reported the number of natural teeth present (all = 28, excluding wisdom teeth) and dental prostheses (crowns, bridges, removable prostheses and/or fixed implants) including the number of implants, for how long the oldest implant had been in place (in years), and whether any of their implants had been removed or replaced.

Global health, oral dryness, satisfaction with dental implants and dental care in general were reported on numerical rating scales (NRS 0-10). Patients also reported their attitudes towards dental implants (in need of, interested in, or afraid of complications). Those with implants were asked whether they would recommend dental implants to other patients with SS (without hesitation, rather yes, rather no, not at all). All participants reported on comorbid conditions (osteoporosis, diabetes mellitus, hyperthyroidism and cancer) and medications (glucocorticoids, bisphosphonates, anticoagulants, anticonvulsives, and chemotherapy) that may interfere with bone remodeling. Ethical approval was obtained from the Charité University Medicine Berlin ethical review board in April 2009. All patients gave informed written consent to participate.

### **Statistical analysis**

Descriptive analyses were performed to evaluate the number of patients with oral complaints, the number of teeth, their provision with dental prostheses and

satisfaction with dental care. Chi square statistics and Fisher's exact test were used to determine differences in the categorical variables of patients and controls with and without dental implants. The independent sample t test was used for continuous measures.

The association between demographic and clinical parameters and considerable tooth loss ( $\leq 20$  teeth left) was examined using multivariable logistic regression analysis. Predictor variables were age (continuous), formal education (compulsory, secondary, or higher), smoking (never, past, or currently), body mass index ( $< 20$ ,  $20 - < 25$ ,  $25 - < 30$ , or  $\geq 30$ ), diabetes mellitus (yes/no), duration of oral dryness ( $\leq 10$ ,  $11 - 20$ , or  $> 20$  years), severity of oral dryness (NRS  $0 - 10$ ), self-reported periodontitis (yes/no), frequent caries in adolescence (yes/no) and frequent bleeding of the gums in adolescence (yes/no). The model with three covariates and the best likelihood score was selected.

In a multivariable logistic regression analysis, predictors of satisfaction with dental implants (lower versus high satisfaction: NRS  $\geq 3$  vs.  $< 3$ ) were analyzed, considering age, possible contraindications for implant therapy, such as osteoporosis, diabetes mellitus, cancer, hyperthyroidism, glucocorticoids, bisphosphonates, anticoagulants, anticonvulsants and chemotherapy (yes/no), as well as the oral parameters listed above as covariates.

To verify whether patients with dental implants were selected for this treatment because of their low risk profile, patients with and without dental implants were compared using Chi square test and Fisher's exact test as appropriate with regard to the comorbid conditions and drugs listed above.

## **Results**



## **Patients and controls**

A total of 230 patients from the Sjögren cohort and 89 controls were asked to answer the dental questionnaire. The data from 205 patients and 87 controls were available for analysis. 25 patients did not answer the questionnaire. A total of 76% of patients were diagnosed with primary and 24% with secondary SS. The controls were aimed to have a comparable age as the patients but they ended to be on average four years younger than patients. They also had a higher educational level and were more frequently current smokers. They differed substantially in the prevalence of self-reported toothache, self-reported periodontitis and the number of natural teeth. Patients were more likely to have removable prostheses and dental implants (Table 1).

## **Number of natural teeth**

Patients of higher age, with lower formal education, longstanding oral dryness and current severe oral dryness reported the lowest numbers of natural teeth. Tooth loss was furthermore associated with self-reported periodontitis, self-reported frequent caries and frequently bleeding gums in adolescence (Table 2). Smokers and adipose patients did not report fewer teeth than non-smokers or those with normal weight (not shown). Smoking was very rare (5.3%) in patients with multiple oral problems and predominantly reported by younger patients whose teeth remained. In addition, age, oral dryness and severe caries in adolescence were the best independent predictors of considerable tooth loss ( $\leq 20$  teeth left; 34% of patients) in multivariable logistic regression analyses ( $\leq 20$  vs.  $> 20$  teeth: adjusted odds ratio (OR) caries vs. no = 4.0, 95% CI 1.8 to 8.5;  $P = < 0.001$  and oral dryness adjusted OR per unit 1.2, 95% CI 1.1

to 1.4). An alternative linear regression with the number of teeth as the continuous variable confirmed the results of the binary logistic regression in general.

### **Dental implants**

More patients (16%) than controls (7%) had dental implants. Patients and controls with implants were older and had fewer remaining teeth than participants without dental implants (Table 3). These differences were statistically significant for SS patients only. In SS patients with dental implants, the mean age of the oldest existing implant was 4.9 years. Five of 104 implants in SS patients had to be removed. One of the five removed implants had been replaced.

### **Comorbid conditions and therapies**

A total of 59% of the patients with dental implants reported taking at least one drug considered a risk factor for implant failure, whereas none of the controls with implants took any of these drugs. Hyperthyroidism and diabetes were equally frequent in patients with and without implants, whereas osteoporosis and the use of bisphosphonates were markedly higher in patients without implants (Table 4).

### **Satisfaction with dental implants**

A total of 75% of the patients with dental implants were highly satisfied with their restorations (NRS 0-2), including three of five patients who had lost one implant each. The remaining patients indicated at least moderate satisfaction (NRS 3-5). The 32 SS patients with implants reported similar satisfaction levels with their implants as the six control subjects with implants (patients vs. controls NRS 1.5 vs. 0.7;  $p = 0.21$ ).

A total of 21 of 32 patients (66%) would recommend dental implants without hesitation to other SS patients; 10 would rather recommend them, and only one

would rather not recommend them. Patients with implants indicated higher satisfaction with their overall dental care than patients without (NRS  $1.8 \pm 1.6$  vs.  $3.7 \pm 2.9$ ;  $p < 0.001$ ). The multivariable logistic regression analysis retrieved no predictors of moderate or poor satisfaction (NRS  $\geq 3$ ;  $n = 9$ ).

### **Attitudes towards dental implants**

Patients and controls without dental implants had similar attitudes towards artificial teeth. About half of both groups indicated no interest in this type of treatment, and approximately one fifth of both groups reported they were determined to obtain implants (Table 5). Beyond that, the two groups differed substantially. Patients indicated greater need for implants and greater concern about not being able to afford them. Patients were also more likely to rate their knowledge about dental implants as insufficient but were twice as likely to express their apprehension that implants could not integrate properly. Attitudes towards implants were only moderately associated with the number of teeth in both groups. Attitudes were not associated with the severity of oral dryness in the patients. A total of 87 patients and 25 controls had already discussed implant therapy with their dentist and 9 patients had talked about implants with their rheumatologist. Of those, 33 patients and 5 controls were advised against implants by their dentist, 1 patient was advised against implants by her rheumatologist and 1 patient by both. In 30 out of 33 patients who were advised against implants, dentists were concerned about initial osseointegration or a higher risk of implant failure. Only a minority of patients, regardless of implant status, knew that statutory health insurance grants full coverage of costs for dental implant therapy in patients with severe oral dryness since 2006 in Germany (with implants 28%, without implants 6%). Notably, only six patients had heard about the

indication from their dentist, and only ten patients had discussed dental implant therapy with their rheumatologist.

## **Discussion**

In this large cohort of patients with SS, a considerable proportion had dental implants. Patients with SS had fewer teeth than controls, and tooth loss was associated with rheumatoid arthritis and also with self-reported periodontitis. The patients were in general highly satisfied with their dental implants, and all but one would recommend dental implants to other patients with SS.

The substantial prevalence of dental implants and the patient perspectives of the present cohort show that dental implants are highly regarded by these patients. High satisfaction was also found in patients with additional comorbid conditions and therapies that interfere with the immune system.

In a recent systematic review, an implant survival rate of 92% in SS patients is reported with a mean observation period of 48 months. However, the SS patient number was only 17 (19). Common implant therapy in SS patients (21%), a high implant survival (97%, with a medium follow up of 46 months) and a high patient satisfaction are also reported from a recent cohort study on 50 SS patients with dental implants and matched controls (16). Data from studies reporting on implant failure risks are heterogeneous, and the level of evidence regarding contraindications for implant therapy remains low (10;20-24). In the majority of cases in which an implant fails to integrate, the cause is unknown (19). Our findings from the present study suggest that SS itself does negatively affect the biology of osseointegration.

A rather large number of dentists and rheumatologists advised the patients not to have dental implants. The majority of them had expressed concerns about initial

osseointegration or a higher risk of implant failure. In addition, we cannot rule out that other aspects such as the specific dental status of the included patients were responsible for implant therapy not being recommended. However, our data and those reported by Korfage et al. (16) suggest that dental implants should be considered by dentists and rheumatologists as a viable treatment option in patients with SS.

#### Limitations and strengths

The lack of data from a clinical dental examination is an important limitation as the condition of the peri-implant mucositis and peri-implantitis could not be evaluated. Furthermore, self-reported gingivitis and self-reported periodontitis has limited validity (25), and the associated results need to be interpreted with caution. It should be noted that prevalence of self-reported periodontitis in our study was much lower than that of clinically assessed moderate or severe periodontitis (46%) in a recent study of SS patients (26). The control group differs considerably in age, educational level and smoking, all of which may influence gum inflammation, periodontal and implant status. Furthermore, the number of subjects with implants and failed implants is too small to establish risk factors for implant loss. A risk rate for the loss of an implant could not be calculated because information on the time to implant loss or on the age of all remaining implants is missing. The patients only recorded the longest standing implant, which might obscure the implant survival rate. The strength of the study is the large sample size and the provision of patient-reported satisfaction with dental implants that should be equally considered for clinical outcomes.

Our findings reported here are consistent with the study by Korfage et al. and encourage the consideration of implants in the dental treatment of SS patients (16). However, because of the limitations of a retrospective assessment of implant failure

and the limitation of patient self-reports, as well as the high need for dental implants in this group of patients, a prospective study that includes clinical and radiographic dental data is still required.

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