The Prevalence of Dental Implants and Related Factors in Patients with Sjögren Syndrome: Results from a Cohort Study

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ABSTRACT. ***Objective.*** To investigate prevalence and patient-reported outcomes of dental implants in patients with Sjögren 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 older than the controls (58 ± 12 and 54 ± 14 yrs, respectively) and differed substantially in the prevalence of self-reported gingivitis (60% and 35%), self-reported periodontitis (19% and 8%), and in the numbers of remaining teeth (21 ± 7 and 24 ± 5). Patients more frequently had removable prostheses (36% compared with 23%) and dental implants (16% compared with 7%). The 32 patients with SS with dental implants had a mean number of 3.1 ± 2.0 implants. Notably, for patients with implants, their oldest existing implant survived for a mean period of 4.9 ± 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 patients with SS.

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 patients with SS. (First Release May 1 2016; J Rheumatol 2016;43:1380–5; doi:10.3899/jrheum.151167)

Key Indexing Terms:
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Primary and secondary Sjögren 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[1,2,3,4]. It also stimulates soft tissue repair by reducing clotting time and accelerating wound contraction. Further, it contains numerous antibacterial, antiviral, and antifungal agents that modulate the oral microbial flora[3,4,5].

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[6,7,8]. Because of 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, reduces retention of dentures, and other complications, such as local candida infections.

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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 (RA), osteoporosis, diabetes mellitus (DM), 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 cohort study and several case reports and case series on dental implants in patients with SS already indicate the feasibility of implant therapy for patients with SS[11,12,13,14,15,16].

The aim of our 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.

MATERIALS AND METHODS

The data of women with SS from an observational prospective cohort study in Germany were used. Enrollment with annual followup was initiated in 2009 in 4 specialized rheumatologic centers in Germany that were participating in a collaborative project promoted by the European League Against Rheumatism 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 about the same age (± 3 yrs) who were not experiencing dry eyes or dry mouth. Details regarding recruitment and annual followups 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 mos/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 yrs), 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 toward 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, DM, 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 tests were used to determine differences in the categorical variables of patients and controls with and without dental implants. The independent sample Student t test was used for continuous measures.

The association between demographic and clinical variables and considerable tooth loss (≤ 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 to < 25, 25 to < 30, or ≥ 30), DM (yes/no), duration of oral dryness (≤ 10, 11–20, or > 20 yrs), 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 3 covariates and the best likelihood score was selected.

In a multivariable logistic regression analysis, predictors of satisfaction with dental implants (lower vs high satisfaction: NRS ≥ 3 vs < 3) were analyzed, considering age, possible contraindications for implant therapy such as osteoporosis, DM, cancer, hyperthyroidism, glucocorticoids, bisphosphonates, anticoagulants, anticonvulsants, and chemotherapy (yes/no), as well as the oral variables 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 the 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. Twenty-five patients did not answer the questionnaire. Of the patients, 76% were diagnosed with primary and 24% with secondary SS. The aim was for the controls to be comparable in age to the patients, but they resulted in being an average 4 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 fewest natural teeth. Tooth loss was further associated with self-reported periodontitis, self-reported frequent caries, and gums that bled frequently in adolescence (Table 2). Smokers and adipose patients did not report fewer teeth than nonsmokers or those with normal weight (not shown). Smoking was very rare (5.3%) in patients with multiple oral problems and was 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 (≤ 20 teeth left; 34% of patients) in multivariable logistic regression analyses (≤ 20 vs > 20 teeth: adjusted OR caries vs no = 4.0, 95% CI 1.8–8.5, p = < 0.001, and oral dryness adjusted OR per unit = 1.2, 95% CI 1.1–1.4). An alternative

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Table 1. Self-reported demographic and clinical features of patients with Sjögren syndrome and controls. Values are % unless otherwise specified.

Variables	Patients, n = 205	Controls, n = 87
Age, yrs, mean ± SD (range)	58.1 ± 12 (24–80)	54.1 ± 14 (19–76)
Education		
Compulsory	20.3	8.5
Secondary	38.1	40.2
Higher	41.6	51.3
Smoking		
Never	62.8	58.6
Former	31.6	19.6
Current	5.4	21.8
Age of xerostomia onset, yrs, mean ± SD (range)	42.4 ± 14.2 (12–72)	—
Toothache last 4 weeks	48.8	11.5
Bleeding of the gums last 4 weeks, gingivitis	60.4	34.5
Self-reported periodontitis	19.0	8.0
Current no. natural teeth, mean ± SD (median)	21.2 ± 7.3 (24)	23.8 ± 4.7 (25)
Edentulous	2.9	0
Removable partial prostheses	23.0	19.5
Removable total prostheses, upper or lower jaw	12.8	3.5
Individuals with dental implants, n (%)	32 (15.6)	6 (6.9)

Table 2. Mean number of teeth by age, and previous as well as current oral problems in patients with Sjögren syndrome.

Variables	%	Teeth, n	p
Age, yrs			< 0.001
≤ 50	23.2	25.5	
51–60	33.5	20.7	
61–70	23.8	20.7	
> 70	19.5	17.3	
Education			0.019
Compulsory	20.3	19.4	
Secondary	38.1	20.2	
Higher	41.6	22.8	
Yrs with oral dryness			0.01
≤ 10	33.5	23.0	
11–20	40.0	20.0	
> 20	26.5	19.0	
Current severity of oral dryness, NRS, 0–10			< 0.001
0–2	16.1	25.4	
3–6	26.3	21.0	
7–10	57.6	20.1	
Self-reported frequent caries in adolescence			< 0.001
Yes	29.5	18.7	
No	70.2	22.3	
Self-reported frequently bleeding gums in adolescence			0.002
Yes	15.6	18.8	
No	84.4	21.7	
Self-reported periodontitis			< 0.001
Yes	19.0	17.7	
No	81.0	22.9	

NRS: numeric rating scale.

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 only for patients with SS. In patients with SS who had dental implants, the mean age of the oldest existing implant was 4.9 years. Five of 104 implants in patients with SS had to be removed. One of the 5 removed implants had been replaced.

Comorbid conditions and therapies. Of the patients with dental implants, 59% reported taking at least 1 drug considered a risk factor for implant failure, whereas none of the controls with implants took any of those 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

Table 3. Dental implants in patients with Sjögren syndrome and controls.

Variables	Patients, n = 205	Controls, n = 87
Participants with dental implants, n (%)	32 (15.6)	6 (6.9)
Dental implants ever, n	104	14
Current dental implants, n	100	14
Dental implants currently, mean ± SD (range)	3.1 ± 2.0 (1–8)	2.3 ± 1.9 (1–6)
Age of participants with vs without implants, yrs, mean	64.5 vs 57.0	63.2 vs 53.5
No. teeth in participants with vs without implants, mean	17.5 vs 21.9	21.5 vs 24.0
Age of the oldest of the current implants, yrs, mean ± SD (median)	4.9 ± 5.4 (3)	2.4 ± 1.8 (2)
Removed implants, n (%)	4 (3.8)	0 (0)
Replaced implants, n (%)	1 (1.0)	0 (0)

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Table 4. Comorbid conditions and therapies in patients with and without dental implants. Values are % unless otherwise specified.

Variables	Patients with Dental Implants, n = 32	Patients without Dental Implants, n = 173	p
Age, yrs, mean	64.5	57.0	0.003
Osteoporosis	15.6	24.3	0.28
Diabetes mellitus	3.1	5.8	1.00
Cancer	9.4	12.1	1.00
Hyperthyroidism	12.5	11.6	0.77
Glucocorticoids	53.1	61.9	0.35
Bisphosphonates	3.1	12.7	0.14
Anticoagulants	12.5	15.6	0.79
Anticonvulsants	9.4	8.1	0.73
Chemotherapy	3.1	7.5	0.70

Table 5. Attitudes toward dental implants of patients and controls without implants. Values are % unless otherwise specified.

Statements	Patients, n = 173	Controls, n = 81	p
I am not interested in dental implants.	54.1	51.3	0.68
I do not need/want dental implants.	40.1	52.5	0.065
I am afraid that dental implants would not integrate properly.	40.1	18.8	< 0.001
I am firmly determined to get dental implants.	14.6	20.0	0.28
I would like to have implants, but cannot afford them.	33.3	21.1	0.097
I do not know enough about dental implants to form an opinion.	51.7	30.0	0.001

restorations (NRS 0–2), including 3 of 5 patients who had lost 1 implant each. The remaining patients indicated at least moderate satisfaction (NRS 3–5). The 32 patients with SS who had implants reported satisfaction levels with their implants similar to the 6 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 patients with SS, 10 would rather recommend them, and only 1 would rather not recommend them. Patients with implants indicated higher satisfaction with their overall dental care than patients without (NRS 1.8 ± 1.6 vs 3.7 ± 2.9, p < 0.001). The multivariable logistic regression analysis retrieved no predictors of moderate or poor satisfaction (NRS ≥ 3, n = 9).

Attitudes toward dental implants. Patients and controls without dental implants had similar attitudes toward artificial teeth. About half of both groups indicated no interest in this type of treatment, and about one-fifth of both groups reported they were determined to obtain implants (Table 5). Beyond that, the 2 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 toward 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 granted 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 6 patients had heard about the indication from their dentist, and only 10 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 RA and also with self-reported periodontitis. The patients were, in general, highly satisfied with their dental implants, and all but 1 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 patients with SS was reported with a mean observation period of 48 months. However, the number of patients with SS was only 17[19]. Common implant therapy in patients with SS (21%), a high implant survival (97%, with a medium followup of 46 mos), and a high patient satisfaction were also reported from a recent cohort study on 50 patients with SS 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[10,20,21,22,23,24]. In the majority of cases in which an implant fails to integrate, the cause is unknown[19]. The findings from our present study suggest that SS itself does not impair 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

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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 because the condition of the peri-implant mucositis and peri-implantitis could not be evaluated. Further, self-reported gingivitis and self-reported periodontitis have 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 patients with SS[26]. The control group differs considerably in age, educational level, and smoking, all of which may influence gum inflammation, periodontal, and implant status. Further, 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 our 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 patients with SS[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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