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### ► **To cite this version:**

Marie Orliaguet, Karen Vallaey, Stephanie Leger, Franck Decup, Brigitte Grosgeat, et al.. Dental needs in patients with Sjögren's disease compared to the general population: A cross-sectional study. *Journal of Dentistry*, 2025, 159, pp.105816. <10.1016/j.jdent.2025.105816>. <hal-05115312>

**HAL Id: hal-05115312**

**<https://hal.science/hal-05115312v1>**

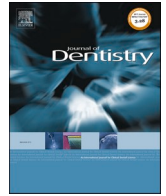
Submitted on 16 Jun 2025

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# Dental needs in patients with Sjögren's disease compared to the general population: A cross-sectional study

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## ARTICLE INFO

### Keywords:

Carious lesion  
Wear lesion  
Oral health  
Sjögren's disease  
Xerostomia  
RESTO DATA study  
ReCOL (dental practice-based research network)

## ABSTRACT

**Objectives:** To describe the dental health status of patients with Sjögren's disease (SD), particularly as concerns care needs, coronal restoration quality, the prevalence of caries and wear lesions, relative to the general population from the RESTO DATA study.

**Materials and methods:** Thirty-eight patients with SD were recruited during specialist consultations at Brest University Hospital and Charles Foix Hospital in Paris between December 2020 and December 2021. A questionnaire was used to record data for dental risk factors. Dental health status was assessed with the DMF-T index, ICDAS score, and the BEWE coding system, and oral health-related quality of life was assessed with the OHIP-14. The Xerostomia Inventory was used to evaluate xerostomia symptoms. Unstimulated and stimulated salivary flows were measured, together with saliva pH and buffering capacity.

**Results:** The SD patients had more visible heavy dental plaque on teeth, a high prevalence of non-cavitated carious lesions, a large number of restored teeth, a high prevalence of cervical lesions, secondary caries, restoration failure, and a high percentage of wear lesions, despite regular attendance and correct eating habits. In the SD population, the characteristics of carious and wear lesions and the status of restorations were influenced by salivary flows. The SD population had a significantly poorer oral quality of life.

**Conclusions:** These results confirm that SD is associated with oral health issues, with increases in the risks of carious lesions, wear lesions, and restoration failures. These findings could serve as early warning signs for oral healthcare professionals in the context of Sjögren's disease diagnosis.

## 1. Introduction

Sjögren's disease (SD) is a systemic autoimmune disease with a prevalence ranging from 1 to 23 cases per 10,000 inhabitants in European countries [1]. It disproportionately affects women, with a female-to-male ratio of 9:1, and its incidence peaks around the age of 50

years [2,3]. SD is characterized by a triad of symptoms: dryness, pain, and fatigue, with xerostomia having a particularly detrimental effect on quality of life [4]. Saliva plays a fundamental role in oral homeostasis, facilitating mastication, digestion, and preserving the integrity of dental hard tissues through its lubricating, buffering, and remineralizing properties [5–7]. The hyposialia frequently present in SD is associated

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<https://doi.org/10.1016/j.jdent.2025.105816>

Received 27 March 2025; Received in revised form 8 May 2025; Accepted 11 May 2025

Available online 12 May 2025

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with an increase in the prevalence of dental caries, oral ulcerations, and compromised periodontal and gingival health [8–12]. It may also have effects on other aspects of dental health, such as wear and restoration quality, but these effects are insufficiently understood.

We therefore evaluated the oral and dental health status of patients with primary or secondary SD during specialist hospital consultations. This specific patient population was compared with the general population. A multicenter cross-sectional observational study, RESTO DATA [13,14], was recently conducted in France, in both hospital settings and private practices, via the ReCOL network. This study aimed to provide an overview of the current state of oral health, including a comprehensive analysis of dental restorations over time and a study of contextual factors influencing oral health [15]. An ancillary study was then planned. The primary objective of this study remained the assessment of coronal restorations, to remain in line with the RESTO DATA study, the only modification being the specific patient population studied. The secondary objectives include a detailed assessment of oral health status and an evaluation of quality of life in adult patients with SD.

## 2. Materials and methods

### 2.1. Study design

This observational, multicenter, cross-sectional study is a continuation of the preceding RESTO DATA study. Like the rest of the RESTO DATA study, it was conducted in accordance with the STROBE declaration and within RECOL, a research network based on dental practices and university hospitals, with the Hospices Civils de Lyon (HCL) as the study promoter [13,14,16].

### 2.2. Study population

The patient inclusion criteria were as in the other RESTO DATA studies — at least one tooth with a coronal restoration and no history of dental examination in the last six months [13,14,16] — but with the additional inclusion criterion that the patient had to have consulted a specialist service for Sjögren's disease. SD diagnosis was made at a multidisciplinary consultation meeting, in accordance with the ACR/EULAR classification criteria [17].

Thirty-eight patients with SD attending specialist consultations for SD at the local reference centers for SD at Brest University Hospital or Charles Foix Hospital in Paris were consecutively recruited from December 2020 to December 2021.

### 2.3. Outcomes and general characteristics

Environment-related factors were recorded with a specific questionnaire. As recommended by the ICCMS™ (for International Caries Classification and Management System), these factors included dental hygiene habits, saliva-reducing factors, and frequent snacking or an unbalanced diet [18].

Oral health status was assessed by counting the numbers of decayed, missing or filled permanent teeth (DMF-T index) [19–21]. Each tooth was assessed by clinical examination (visual and tactile examination with of periodontal probe). Dental caries were scored with a simplified ICDAS score (International Caries Detection and Assessment System: enamel carious lesion: ICDAS 1–3, or dentin carious lesion: ICDAS 4–6) [22]. Dental restorations were assessed with a simplified rating scale based on seven criteria from the FDI World Dental Federation. A dental restoration was considered to have failed if a major deviation was observed for at least one of seven FDI criteria (3 to 8 + 14) [20]. Tooth wear lesions were assessed with the BEWE (Basic Erosive Wear Examination) coding system [23]. Patients were considered to be at high risk (caries and/or wear lesions) if they had at least one severely decayed tooth (ICDAS 4–6) or at least one tooth with a BEWE score of 2 or 3 [24].

Oral health-related quality of life was assessed with the short version of the self-administered 14-item Oral Health Impact Profile questionnaire (OHIP-14) [25,26].

Several additional specific outcomes were also considered for this study. The Xerostomia Inventory, a validated patient-reported xerostomia questionnaire, was used to measure the symptoms of xerostomia [27]; the ranges of values associated with each category were as follows: 0–11: no xerostomia versus 12–22: mild xerostomia versus 23–33: moderate xerostomia versus 34–44: severe xerostomia.

Unstimulated salivary flow (USF) and stimulated salivary flow (SSF) rates were measured for a duration of 5 min, without stimulation for USF and with the chewing of paraffin for SSF. Saliva pH and buffering capacity were measured with a strip of pH paper and specific strips according to the Saliva Check Buffer kit (GC® Saliva Check Buffer) (scored according to the manufacturer's guidelines: very low buffer capacity: 0–5, low buffer capacity: 6–9 and normal buffer capacity: 10–12).

### 2.4. Data management

All data were collected in an eCRF (electronic case report form - Clininfo, Lyon, France). Interactive controls were used to check data ranges and consistency between forms. In compliance with the directives of the French 'Commission Nationale de l'Informatique et des Libertés' (CNIL) and the European General Data Protection Regulation (EU 2016/679), all data were kept anonymous, with highly secure storage and the encryption of all transfers.

### 2.5. Statistical analysis

Qualitative variables are expressed as numbers and percentages for each category within each group. Quantitative variables are expressed as medians and interquartile ranges.

We used  $\chi^2$  tests or Fisher's exact tests, as appropriate, for comparisons of qualitative variables. For quantitative variables, Student's *t* tests were performed to compare two means, and analysis of variance (ANOVA) was used to compare three means.

The data analysis was performed with Python, in the Jupyter notebook environment (Anaconda navigator version 4.13.0 and Python version 3.9.12). The Pandas and numpy packages were used for data importation and data processing. Scipy library was used for  $\chi^2$  tests, *t*-tests and ANOVA, and rpy2 library was used for Fisher's exact tests.

### 2.6. Ethical considerations

The study protocol was approved by the local committee for ethics in research (Comité de Protection des Personnes Île-de-France III (3660-NI 01/29/2019) and was registered on ClinicalTrials.gov (no. NCT03854526). Following the initial inclusions in the RESTO DATA study, this work was subject to an additional regulatory process involving the ethics committee (3660-NI 24/07/2020) and an update on the Clinical Trials database to include a specific population. All potential participants received full written information about the study and signed a consent form for participation.

## 3. Results

### 3.1. Study population characteristics

The characteristics of the study population are reported in Table 1. Female and older patients were overrepresented in the SS population than in the general population, and the SS population had poorer self-reported general health. Most patients had a primary syndrome disease, a salivary pH >6.8 and a saliva buffering capacity between 10 and 12. SS patients had severe xerostomia (score > 34) (full items in supplementary file) but salivary flow was reduced in only some of these patients (Table 2).

**Table 1**  
Characteristics of the Sjögren’s disease (SD) population compared to the RESTO DATA general population.

Characteristics	RESTO DATA general population * n = 822 (%)	SD population n = 38 (%)	P value
<b>Age, years, n (%)</b>			<b>0.001</b>
18–29	208 (25)	2 (5)	
30–59	434 (53)	20 (53)	
≥ 60	180 (22)	16 (42)	
<b>Gender, n (%)</b>			<b>&lt;0.0001</b>
Female	467 (57)	35 (92)	
Male	355 (43)	3 (8)	
<b>Occupation, n (%)</b>			<b>0.01</b>
Self-employed and senior management	224 (27)	7 (18)	
Intermediate, employees and workers	276 (34)	16 (42)	
Retired	145 (18)	12 (32)	
No occupation	63 (7)	3 (8)	
Other (e.g. student)	114 (14)	0 (0)	
<b>Health (%)</b>			<b>&lt;0.0001</b>
Self-reported good health	519(63)	0 (0)	
Self-reported disease (>1)	303(37)	38 (100)	

\* Results from previous RESTO DATA studies.

**Table 2**  
Characteristics of the Sjögren’s disease (SD) population.

Characteristics	n= (%)
<b>Sjögren’s disease</b>	
Primary	30 (79)
Associated	8 (21)
<b>Treatments</b>	
Salivary substitute	13 (34 %)
Systemic treatment	18 (47 %)
Pilocarpine	13 (72 %)
Other / Don’t remember	5 (28 %)
<b>Salivary flow</b>	
USF <0.1 mL/min	11 (29 %)
SSF ≤0.7mL/min	18 (47 %)
USF <0.1 mL/min AND SSF ≤0.7mL/min	11 (29 %)
<b>pH</b>	
<5.8	2 (5 %)
6–6.8	15 (40 %)
>6.8	21 (55 %)
<b>Buffer capacity</b>	
0–5	5 (16 %)
6–9	5 (16 %)
10–12	22 (68 %)
Xerostomia Inventory – Total score	38.1 ± 8.5

USF: unstimulated salivary flow; SSF: stimulated salivary flow.

In terms of oral health risk factors (Table 3), SD patients saw a dentist more frequently than the RESTO DATA general population and had better eating habits, but with a higher incidence of declared gastroesophageal reflux disease (GERD) and more visible heavy dental plaque on teeth.

The SD population had a higher prevalence of non-cavitated carious lesions (ICDAS 1–3) than the general population of the RESTO DATA study ( $p = 0.17$ ), and a significantly higher number of restored teeth ( $p < 0.0001$ ). The SD group also had a higher prevalence of cervical lesions, secondary caries, and restoration failure ( $p < 0.0001$ ) but no significant differences were observed in terms of carious lesions with dentin involvement (Table 4). The number of teeth affected by wear and the percentage of patients with wear lesions were notably higher in the SD population ( $p < 0.0001$ ). A higher prevalence of severe forms with dentinal erosive damage (scored as BEWE 2–3) was also evident in the SD population.

In the SD population, the characteristics of carious and wear lesions and the status of restorations were influenced by salivary flow.

**Table 3**  
Oral health risk factors of the Sjögren’s disease (SD) population compared to the RESTO DATA general population.

	RESTO DATA general population * n = 822 (%)	SD population n = 38 (%)	P value
<b>Dental visits, n (%)</b>			<b>0.0002</b>
Regular (biannual, annual)	472 (57)	33 (87)	
Irregular (≥ 2 years)	350 (43)	5 (13)	
Frequency of tooth brushing, n (%)			0.15
<1 time per day	123 (15)	2 (5)	
≥1 time per day	699 (85)	36 (95)	
Occupational risk	105 (13)	3 (8)	0.61
Excessive consumption of sugary/acidic beverages	218 (26)	5 (13)	0.09
Bad eating habits	338 (41)	7 (18)	<b>0.009</b>
GERD	59 (7)	7 (18)	<b>0.02</b>
Excessive alcohol consumption	86 (10)	4 (11)	1
Current smoker	165 (20)	1 (3)	<b>0.005</b>
Visible heavy plaque on teeth	283 (34)	21 (55)	<b>0.01</b>

\* Results from previous RESTO DATA studies; GERD: gastroesophageal reflux disease

**Table 4**  
Tooth-related factors in the Sjögren’s disease (SD) population compared to the general population (mean ±SD).

	RESTO DATA general population* n = 822	SD population n = 37	P value
<b>Dental caries, n (%)</b>	382 (46)	22 (59)	0.17
≥ 1 ICDAS 1–3 CL	88 (11)	10 (27)	<b>0.009</b>
≥ 1 ICDAS 4–6 CL	294 (36)	12 (32)	
DMF-T index, mean (±SD)*	10.4 (6)	17.2 (6)	<b>&lt;0.0001</b>
Number of restored teeth	7.5 (5)	14.4 (5)	<b>&lt;0.0001</b>
Number of missing teeth	2.3 (4)	2.6 (4)	0.6
Number of carious lesions	1.4 (3)	2.9 (4)	<b>0.002</b>
ICDAS 1–3 CL	0.5 (1)	2 (3)	<b>&lt;0.0001</b>
ICDAS 4–6 CL	0.9 (2)	0.9 (1.6)	0.99
Number of cervical CL, mean (±SD)	0.3 (1)	1.5 (3)	<b>&lt;0.0001</b>
Number of secondary CL, mean (±SD)	0.5 (1)	1.8 (3)	<b>&lt;0.0001</b>
Number of restoration failures, mean (±SD)	3 (3)	6.5 (5)	<b>&lt;0.0001</b>
<b>Tooth wear, n (%)</b>	309 (38)	32 (86)	<b>&lt;0.0001</b>
≥ 1 WL BEWE 1	119 (14)	4 (11)	<b>&lt;0.0001</b>
≥ 1 WL BEWE 2–3	190 (23)	28 (76)	
Number of tooth wear, mean (±SD)	2.5 (5)	8.7 (7)	<b>&lt;0.0001</b>
Number of tooth wear (BEWE 2–3)	1.2 (3)	5.4 (6)	<b>&lt;0.0001</b>

\* Results from previous RESTO DATA studies; BEWE: Basic Erosive Wear Examination, CL: carious lesion, DMF-T: decayed, missing or filled permanent teeth, ICDAS: International Caries Detection and Assessment System, WL: wear lesion

Individuals with an unstimulated saliva flow < 0.1 mL/min and a stimulated saliva flow < 0.7 mL/min had larger numbers of carious lesions, and these lesions were more advanced and/or secondary in nature (Table 5). In addition, the severity of tooth wear lesions appeared to be correlated with the reduction of salivary flow (Table 5).

The SD population had significantly higher scores on the OHIP-14 questionnaire (Table 6) for almost all domains (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability and handicap), indicating a significantly poorer oral quality of life in this population.

#### 4. Discussion

In this study, we investigated the dental health status of patients with

**Table 5**

Tooth-related factors in the Sjögren's disease (SD) population according to unstimulated (USF) and stimulated (SSF) salivary flow.

	USF <0.1 mL/min and SSF <0.7 mL/min n = 11	USF <0.1 mL/min OR SSF <0.7 mL/min n = 7	USF >0.1 mL/min AND SSF >0.7 mL/min n = 19	P value
Dental caries, n (%)	10 (91 %)	4 (57 %)	8 (42 %)	<b>0.03</b>
≥ 1 ICDAS 1–3 lesions	2 (18)	3 (43)	5 (26)	<b>0.01</b>
≥ 1 ICDAS 4–6 lesions	8 (73)	1 (14)	3 (16)	
DMF-T index, mean (±SD)	17.9 (7)	17.1 (8)	16.8 (4)	0.89
Number of restored teeth	14.2 (6)	15.4 (8)	14.1 (4)	0.85
Number of missing teeth	3.1 (4)	1.6 (1)	2.7 (4)	0.72
Number of carious lesions	5.5 (6)	2.4 (4)	1.5 (2)	<b>0.03</b>
ICDAS 1–3 CL	3.3 (4)	2.1 (3)	1.1 (2)	0.21
ICDAS 4–6 CL	2.3 (2)	0.3 (0.8)	0.4 (1)	<b>0.003</b>
Number of cervical tooth caries, mean (±SD)	3.5 (5)	1.1 (2)	0.4 (1)	<b>0.015</b>
Number of secondary tooth caries, mean (±SD)	3.5 (5)	1.3 (2)	0.9 (2)	<b>0.08</b>
Number of restoration failure, mean (±SD)	5.2 (5)	6.9 (4)	7.1 (5)	0.53
Tooth wear, n (%)	10 (91)	7 (100)	15 (79)	0.56
≥ 1 WL BEWE 1	1 (9)	3 (43)	0 (0)	<b>0.03</b>
≥ 1 WL BEWE 2–3	9 (82)	4 (57)	15 (79)	
Number of tooth wear, mean (±SD)	10.9 (9)	9 (9)	7.3 (6)	0.43
Number of tooth wear (BEWE2–3)	6.9 (7)	6.7 (9)	4 (4)	0.39

BEWE: Basic Erosive Wear Examination, CL: carious lesion, DMF-T: decayed, missing or filled permanent teeth, ICDAS: International Caries Detection and Assessment System, USF: unstimulated salivary flow, SSF: stimulated salivary flow, WL: wear lesion.

SD and compared this status with that of an adult general population. More specifically, we focused on the need for and quality of coronal restorations and the prevalence of secondary carious and wear lesions. We found that patients suffering from SD were likely to have a satisfactory oral hygiene habits, but a higher DMF-T index than the general RESTO DATA population, consistent with published findings [28–30]. They also had a higher prevalence of non-cavitated carious lesions (ICDAS 1–3), a larger number of restored teeth and a higher incidence of cervical CLs, secondary CLs, and restoration failure than the RESTO DATA general population. These results are consistent with hyposalivation, which affects the buffering and remineralizing effects of saliva [10,29,30]. Indeed, Caries Care International (CCI™), which promotes a patient-centered, risk-based approach to caries management, classifies the presence of low salivary flow as a pathological factor placing patients at high risk of CLs [31]. CAMBRA (Caries Management by Risk Assessment) even classifies these patients as being at extreme risk of CLs [24]. Hyposalivation has also been shown to increase the amount of heavy plaque visible on the teeth despite regular brushing [32], as observed in the SS population studied here. Finally, lower salivary flow [33] and higher incidence of GERD in the SD population [15,34] may account for the higher prevalence of dental wear lesions, erosion and attrition found in this SD population. In cases of mismatch between the number of carious and wear lesions and restored teeth and the patient's oral hygiene, diet and follow-up habits, it may therefore be

**Table 6**

Results of the OHIP-14 questionnaire.

N = 860	RESTO DATA general population *	SD population	P value
Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	1.2 ± 0.7	2.1 ± 1.1	<0.0001
Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	1.2 ± 0.6	2.1 ± 1.4	<0.0001
Have you had painful aching in your mouth?	2.4 ± 1.1	3 ± 1.4	0.0007
Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	2 ± 1.2	3.1 ± 1.2	<0.0001
Have you been self-conscious because of your teeth, mouth or dentures?	2 ± 1.2	2.6 ± 1.5	0.002
Have you felt tense because of problems with your teeth, mouth or dentures?	1.8 ± 1.1	2.7 ± 1.2	<0.0001
Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	1.5 ± 1	2.3 ± 1.3	<0.0001
Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	1.4 ± 0.8	2.1 ± 1.2	<0.0001
Have you found it difficult to relax because of problems with your teeth, mouth or dentures?	1.6 ± 1	2.1 ± 1.2	0.001
Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	1.8 ± 1.1	2.7 ± 1.2	<0.0001
Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	1.4 ± 0.9	1.9 ± 1.1	0.001
Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	1.3 ± 0.7	1.5 ± 0.7	0.08
Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	1.6 ± 1	2.6 ± 1.3	<0.0001
Have you been totally unable to function because of problems with your teeth, mouth or dentures?	1.1 ± 0.5	1.6 ± 0.9	<0.0001
Total score	<b>22.3 ± 8.8</b>	<b>32.2 ± 10.8</b>	<b>&lt;0.0001</b>

\* Results from previous RESTO DATA studies.

pertinent to consider the possibility of a salivary disorder that could explain the situation [35].

Interestingly, the SD population had a higher incidence of secondary CL and restoration failure despite more frequent oral follow-up than the general population of the RESTO DATA study. This finding supports the notion that this population has specific oral health needs. Similar results for SD patients have already been reported, with a faster failure of direct restorations than in the general population [36]. In addition, the survival time of direct restorations, particularly large composite restorations, and of teeth is significantly lower in patients with dry mouth syndrome. Interestingly, in one study, fixed prosthetic crowns were nevertheless found to have an acceptable survival time in SD patients [37]. In the future, we will perform an analysis of restoration failures in our SD population according to the type of restoration.

The results of the OHIP 14 questionnaire further highlight the profound effect of SD on oral health-related quality of life. The SD population had significantly higher scores across all domains, including

functional limitation, physical pain, psychological discomfort, and physical and psychological disability. This result is consistent with other reports of a poorer oral health-related quality of life whatever the origin of xerostomia [38–40], due to an increase in oral health problems in particular [41].

This study provides valuable insight into the oral health challenges faced by SD patients, but it has several limitations. The cross-sectional design of the study limits its ability to establish causal relationships between SD and oral health outcomes. In terms of salivary flow, only a proportion of the SD population had severe hyposalialia. We used a threshold of 0.1 mL/min for unstimulated saliva as a criterion for disease severity, but most of the patients already presented with hyposalialia if we considered a threshold of 0.3 mL/min. This study did not take into account the date of SD symptom onset. It was not, therefore, possible to investigate the correlation between disease duration and clinical severity. Furthermore, some patients are now undergoing treatment with salivary substitutes and/or stimulants, mostly salivary substitutes (34 %) and pilocarpine (47 %), which has been shown to have a positive impact on saliva flow after three months of treatment [42]. One of the limitations of this study is its limited statistical power. As this was an observational study based on data from "routine" patient consultations, the sample size reflects the recruitment capacity of each participating center. The sample size is also constrained by the rarity of primary Sjögren's disease. The study may therefore have had insufficient power to detect significant differences between groups. Furthermore, given the multiple statistical tests performed on very small samples, may have limited the generalizability of our findings. In addition, the small sample size may not fully capture the diversity of the SD population, especially in terms of disease severity and treatment history. Future studies would benefit from a longitudinal design to explore whether the implementation of appropriate preventive strategies [35], such as increasing the dose of fluoride and rinsing with sodium bicarbonate to improve buffering capacity [24], and the type of restoration used can modify the progression of oral health complications in patients with SD over time.

## 5. Conclusion

This study confirms that Sjögren's disease (SD) has a significant effect on dental health, increasing the risk of carious lesions, wear lesions, and restoration failures. Caution is required when generalizing these findings to the broader SD population, but such oral manifestations may serve as early indicators for diagnosis. The hallmark decreases in salivary flow associated with SD plays a key role in these complications highlighting the need for tailored preventive strategies and close clinical monitoring. Furthermore, the considerable impact of SS on oral health-related quality of life demonstrates the value of an interdisciplinary approach for addressing both systemic and oral aspects of the disease. In cases in which the presence of multiple carious or wear lesions or recurrent restoration failures appears inconsistent with the patient's reported diet and oral hygiene practices — despite regular dental care — an underlying salivary dysfunction should be considered. Effective management of hyposalivation is essential to mitigate these oral complications and to preserve long-term oral and general health.

## CRedit authorship contribution statement

**Marie Orliaguet:** Writing – original draft, Investigation, Data curation. **Karen Vallaëys:** Writing – review & editing, Investigation, Data curation. **Stephanie Leger:** Formal analysis, Data curation, Conceptualization. **Franck Decup:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Brigitte Grosogeat:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Marjolaine Gosset:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

The authors thank Ms Elisa Lethellier, Ms Helene Lozano, Pr Delphine Maucourt-Boulch, Pr François Gueyffier and Dr Patrice Nony (Hospices Civils de Lyon, Lyon, France) for their contribution to the conceptualization, implementation and monitoring of the study.

The authors would also like to thank all the investigators: Abid Sarah, Amzallag Guidoni Valérie, Atlan Anthony, Becavin Thibault, Becquart Mathilde, Berbel Fanny, Bertrand Marie-France, Blanc Cécile, Bondil Xavier, Boudeau Mathilde, Bouyahmed Lydia, Canceill Thibault, Ceinos Romain, Chabanne Anaïs, Chesneau Jonathan, Chomette Gaëlle, Cohen Boulakia Laura, Collignon Anne-Margaux, David Alexandra, Decaup Pierre-Hadrien, Decerle Nicolas, Dechaux Jérémie, Decup Franck, Delarge Dionis Nathalie, Domejean Sophie, Douchy Laura, Drossart Maxime, Drouhet Thibault, Dudouit Laurianne, Dutour François-Marie, Florimond Marion, Fouillen Kevin-John, Franchi Claire, Gasqui Marie- Agnès, Gastineau Richard, Gaucher Céline, Gautherot Stéphanie, Gerentes Philippe, Girschig-Alle Isabelle, Guerrieri Aurélie, Janin Arnaud, Janisset-Masse Nathalie, Kaprielian Nicolas, Kerouredan Olivia, Khoury Claudine, Le Clerc Justine, Lefrançois Etienne, Lesieur Charlène, Loiseau Anne-Claire, Lossi Justine, Maillet Christina, Marniquet Solène, Mesgouez-Menez Catherine, Mifsud Stéphanie, Minassian Harmik, Moussally Christian, My Marie-Anne, Pérard Matthieu, Perier Nicolas, Pieaud Jérôme, Pochelu Florian, Pradelle Nelly, Préaubert Estelle, Reneau Magali, Robberecht Lieven, Robbiani Eric, Sauvagnac Alix, Tixier Jacques, Tournadre Camille, Vallaëys Karen, Vinter Céline, Ziouani-Taïr Nawel.

## Funding

This study was funded by Hospices Civils de Lyon (Lyon, France), Dentsply Sirona (Versailles, France), and Procter & Gamble (France, Asnières-sur-Seine) and Ulabs (Rueil-Malmaison, France).

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jdent.2025.105816](https://doi.org/10.1016/j.jdent.2025.105816).

## Data availability

The data underlying this study are not available because of high probabilities of breach of patient confidentiality.

## References

- [1] P. Brito-Zerón, C. Baldini, H. Bootsma, S.J. Bowman, R. Jonsson, X. Mariette, K. Sivils, E. Theander, A. Tzioufas, M. Ramos-Casals, Sjögren syndrome, *Nat. Rev. Dis. Primers* 2 (2016) 16047.
- [2] D. Cornec, L. Chiche, Is primary Sjögren's syndrome an orphan disease? A critical appraisal of prevalence studies in Europe, *Ann. Rheum. Dis.* 74 (3) (2015) e25.
- [3] G. Maciel, C.S. Crowson, E.L. Matteson, D. Cornec, Prevalence of primary Sjögren's syndrome in a US population-based cohort, *Arthritis Care Res (Hoboken)* 69 (10) (2017) 1612–1616.
- [4] I. Thorne, N. Sutcliffe, Sjogren's syndrome, *Br. J. Hosp. Med. (Lond)* 78 (8) (2017) 438–442.
- [5] C. Dawes, Salivary flow patterns and the health of hard and soft oral tissues, *J. Am. Dental Assoc.* 139 (2008) 18S–24S.
- [6] C. Dawes, A.M.L. Pedersen, A. Villa, J. Ekström, G.B. Proctor, A. Vissink, D. Aframian, R. McGowan, A. Aliko, N. Narayana, Y.W. Sia, R.K. Joshi, S.B. Jensen, A.R. Kerr, A. Wolff, The functions of human saliva: a review sponsored by the World Workshop on Oral Medicine VI, *Arch. Oral Biol.* 60 (6) (2015) 863–874.
- [7] J.D. Featherstone, The science and practice of caries prevention, *J. Am. Dent. Assoc.* 131 (7) (2000) 887–899.

- [8] P.C. Fox, S.J. Bowman, B. Segal, F.B. Vivino, N. Murukutla, K. Choueiri, S. Ogale, L. McLean, Oral involvement in primary Sjögren syndrome, *J. Am. Dental Assoc.* 139 (12) (2008) 1592–1601.
- [9] R.P. Antoniazzi, L.A. Miranda, F.B. Zanatta, A.G. Islabão, A. Gustafsson, G. A. Chiapinotto, R.V. Oppermann, Periodontal conditions of individuals with Sjögren's Syndrome, *J. Periodontol.* 80 (3) (2009) 429–435.
- [10] C.J. Chuang, C.W. Hsu, M.C. Lu, M. Koo, Increased risk of developing dental diseases in patients with primary Sjögren's syndrome-A secondary cohort analysis of population-based claims data, *PLoS One* 15 (9) (2020) e0239442.
- [11] N. Berman, F. Vivino, J. Baker, J. Dunham, A. Pinto, Risk factors for caries development in primary Sjogren syndrome, *Oral. Surg. Oral. Med. Oral. Pathol. Oral. Radiol.* 128 (2) (2019) 117–122.
- [12] S. González, H. Sung, D. Sepúlveda, M. González, C. Molina, Oral manifestations and their treatment in Sjögren's syndrome, *Oral Dis.* 20 (2) (2014) 153–161.
- [13] C. Mailet, F. Decup, E. Dantony, J. Iwaz, C. Chevalier, F. Gueyffier, D. Maucourt-Boulch, B. Grosogeat, J.Le Clerc, Selected and simplified FDI criteria for assessment of restorations, *J. Dent.* 122 (2022) 104109.
- [14] F. Decup, E. Dantony, C. Chevalier, A. David, V. Garyga, M. Tohmé, F. Gueyffier, P. Nony, D. Maucourt-Boulch, B. Grosogeat, Needs for re-intervention on restored teeth in adults: a practice-based study, *Clin. Oral. Investig.* 26 (1) (2022) 789–801.
- [15] F. Decup, S. Léger, S. Lefèvre, S. Doméjean, B. Grosogeat, Risk factors or indicators for dental caries and tooth wear and their relative importance in adults according to age, *J. Dent.* 147 (2024) 105092.
- [16] C. Mocquot, J.N. Vergnes, L. Julien, C. Volgenant, H. de Soet, D. Seux, M. Muller-Bolla, S.E. Kopperud, F. Staxrud, B. Grosogeat, S. Doméjean, How French dentists manage defective restorations: evidence from ReCOL the French dental practice-based research network-A survey study, *J. Dent.* 125 (2022) 104244.
- [17] M.Le Goff, D. Cornec, S. Jousse-Joulin, D. Guellec, S. Costa, T. Marhadour, R. Le Berre, S. Genestet, B. Cochener, S. Boisrame-Gastrin, Y. Renaudineau, J.-O. Pers, A. Saraux, V. Devauchelle-Pensec, Comparison of 2002 AECG and 2016 ACR/EULAR classification criteria and added value of salivary gland ultrasonography in a patient cohort with suspected primary Sjögren's syndrome, *Arthritis Res. Ther.* 19 (1) (2017).
- [18] A.I. Ismail, N.B. Pitts, M. Tellez, Authors of the International Caries, S. Management, the International Caries Classification and Management system (ICCMS™) an example of a Caries management pathway, *BMC Oral. Health* 15 (1) (2015) S9.
- [19] R. Hicckel, J.F. Roulet, S. Bayne, S.D. Heintze, I.A. Mjör, M. Peters, V. Rousson, R. Randall, G. Schmalz, M. Tyas, G. Vanherle, Science Committee Project 2/98-FDI World Dental Federation study design (Part I) and criteria for evaluation (Part II) of direct and indirect restorations including onlays and partial crowns, *J. Adhes. Dent.* 9 (1) (2007) 121–147. Suppl.
- [20] R. Hicckel, A. Peschke, M. Tyas, I. Mjör, S. Bayne, M. Peters, K.A. Hiller, R. Randall, G. Vanherle, S.D. Heintze, FDI World Dental Federation: clinical criteria for the evaluation of direct and indirect restorations-update and clinical examples, *Clin. Oral Investig.* 14 (4) (2010) 349–366.
- [21] T. Marquillier, S. Doméjean, J. Le Clerc, F. Chemla, K. Gritsch, J.C. Maurin, P. Millet, M. Pérard, B. Grosogeat, E. Dursun, The use of FDI criteria in clinical trials on direct dental restorations: a scoping review, *J. Dent.* 68 (2018) 1–9.
- [22] A.I. Ismail, M. Tellez, N.B. Pitts, K.R. Ekstrand, D. Ricketts, C. Longbottom, H. Eggertsson, C. Deery, J. Fisher, D.A. Young, J.D. Featherstone, W. Evans, G. G. Zeller, D. Zero, S. Martignon, M. Fontana, A. Zandona, Caries management pathways preserve dental tissues and promote oral health, *Community Dent. Oral Epidemiol.* 41 (1) (2013) e12–e40.
- [23] C. Ganss, A. Lussi, Diagnosis of erosive tooth wear, *Monogr. Oral Sci.* 25 (2014) 22–31.
- [24] J.D.B. Featherstone, Y.O. Crystal, P. Alston, B.W. Chaffee, S. Doméjean, P. Rechmann, L. Zhan, F. Ramos-Gomez, Evidence-based caries management for all ages-practical guidelines, *Front Oral Health* 2 (2021) 657518.
- [25] G.D. Slade, A.J. Spencer, Development and evaluation of the Oral Health Impact Profile, *Community Dent. Health.* 11 (1) (1994) 3–11.
- [26] G.D. Slade, Derivation and validation of a short-form oral health impact profile, *Community Dent. Oral Epidemiol.* 25 (4) (1997) 284–290.
- [27] W.M. Thomson, J.M. Chalmers, A.J. Spencer, S.M. Williams, The Xerostomia Inventory: a multi-item approach to measuring dry mouth, *Community Dent. Health.* 16 (1) (1999) 12–17.
- [28] S.A. Mathews, B.T. Kurien, R.H. Scofield, Oral manifestations of Sjögren's syndrome, *J. Dent. Res.* 87 (4) (2008) 308–318.
- [29] L.B. Christensen, P.E. Petersen, J.J. Thorn, M. Schjødt, Dental caries and dental health behavior of patients with primary Sjögren syndrome, *Acta Odontol. Scand.* 59 (3) (2001) 116–120.
- [30] I. Stankeviciene, L. Stangvaltaite-Mouhat, J. Aleksejuniene, D. Mieliauskaitė, I. Talijuniene, I. Butrimiene, R. Bendinskaite, A. Puriene, Oral health status, related behaviours and perceived stress in xerostomia, Sicca and Sjögren's syndromes patients - a cross-sectional study, *BMC Oral Health* 24 (1) (2024) 454.
- [31] S. Martignon, N.B. Pitts, G. Goffin, M. Mazevet, G.V.A. Douglas, J.T. Newton, S. Twetman, C. Deery, S. Doméjean, A. Jablonski-Momeni, A. Banerjee, J. Kolkner, D. Ricketts, R.M. Santamaria, CariesCare practice guide: consensus on evidence into practice, *Br. Dent. J.* 227 (5) (2019) 353–362.
- [32] S. Mizutani, D. Ekuni, T. Tomofuji, T. Azuma, K. Kataoka, M. Yamane, Y. Iwasaki, M. Morita, Relationship between xerostomia and gingival condition in young adults, *J. Periodontol. Res.* 50 (1) (2015) 74–79.
- [33] V.I. Madariaga, T. Pereira-Cenci, X.F. Walboomers, B.A.C. Loomans, Association between salivary characteristics and tooth wear: a systematic review and meta-analysis, *J. Dent.* 138 (2023) 104692.
- [34] D. Bartlett, C. Ganss, A. Lussi, Basic Erosive Wear Examination (BEWE): a new scoring system for scientific and clinical needs, *Clin. Oral Investig.* 12 (1) (2008) S65–S68. SupplSuppl 1.
- [35] B.R. Decup F, G. Nocturne, M. Gosset, The role of dental professionals in identifying patients with a suspected primary Sjögren's syndrome and suggestions for prevention and treatment of oral complications: a narrative review, *Heliyon* (2025). IN PRESS.
- [36] G.G.F. Gomez, M. Wang, Z.A. Siddiqui, T. Gonzalez, O.R. Capin, L. Willis, L. Boyd, G.J. Eckert, D.T. Zero, T.P. Thyvalikakath, Longevity of dental restorations in Sjogren's disease patients using electronic dental and health record data, *BMC Oral Health* 24 (1) (2024) 203.
- [37] J. Leinonen, H. Vähänikkilä, E. Raninen, L. Järvelin, R. Näpänkangas, V. Anttonen, The survival time of restorations is shortened in patients with dry mouth, *J. Dent.* 113 (2021) 103794.
- [38] M.L. Nascimento, A.B. Farias, A.T. Carvalho, R.F. Albuquerque, L.N. Ribeiro, J. C. Leao, I.H. Silva, Impact of xerostomia on the quality of life of patients submitted to head and neck radiotherapy, *Med. Oral. Patol. Oral. Cir. Bucal.* 24 (6) (2019) e770–e775.
- [39] J. Serrano, R.M. López-Pintor, M. Fernández-Castro, L. Ramírez, M. Sanz, J. López, M. Blázquez, J.J. González, G. Hernández, Usefulness of implementing the OHIP-14 questionnaire to assess the impact of xerostomia and hyposalivation on quality of life in patients with primary Sjögren's syndrome, *J. Oral Pathol. Med.* 51 (9) (2022) 810–817.
- [40] W.M. Thomson, H.P. Lawrence, J.M. Broadbent, R. Poulton, The impact of xerostomia on oral-health-related quality of life among younger adults, *Health Qual. Life Outcomes* 4 (1) (2006) 86.
- [41] B. Rihab, E.H. Lina, S.-T. Noémie, S. Jean, G. Marjolaine, The experience of dry mouth and screening for Sjogren's syndrome by the dentist: patient-reported experiences, *BMC Oral. Health* 23 (1) (2023) 1010.
- [42] T. Depinoy, A. Saraux, J.O. Pers, S. Boisramé, D. Cornec, T. Marhadour, D. Guellec, V. Devauchelle-Pensec, L. Bressollette, S. Jousse-Joulin, Salivary glands and periodontal changes in a population of Sjögren's and Sicca Syndrome treated by pilocarpine: a pilot study, *Rheumatol Ther* 8 (1) (2021) 219–231.