



**HAL**  
open science

## Poor oral health and hygiene habits in patients with infective endocarditis and previously identified predisposing cardiac condition: A prospective cohort study

Vanessa Moby, Sarah Millot, Marie-Line Erpelding, Edouard Euvrard, Geoffrey Bourgeois, H el ene Martin-Thom e, Catherine Chirouze, Pierre Tattevin, Christophe Strady, Nelly Agrinier, et al.

### ► To cite this version:

Vanessa Moby, Sarah Millot, Marie-Line Erpelding, Edouard Euvrard, Geoffrey Bourgeois, et al.. Poor oral health and hygiene habits in patients with infective endocarditis and previously identified predisposing cardiac condition: A prospective cohort study. *Journal of Infection*, 2022, 84 (5), pp.e58-e61. 10.1016/j.jinf.2022.02.028 . hal-03632293

**HAL Id: hal-03632293**

**<https://hal.science/hal-03632293v1>**

Submitted on 12 Apr 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destin ee au d ep ot et  a la diffusion de documents scientifiques de niveau recherche, publi es ou non,  emanant des  tablissements d'enseignement et de recherche fran ais ou  trangers, des laboratoires publics ou priv es.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

## Letter to the Editor

**Poor oral health and hygiene habits in patients with infective endocarditis and previously identified predisposing cardiac condition: a prospective cohort study**

Vanessa Moby<sup>1,2,3</sup>, Sarah Millot<sup>4,5</sup>, Marie-Line Erpelding<sup>6</sup>, Edouard Euvrard<sup>7,8</sup>, Geoffrey Bourgeois<sup>9</sup>, H el ene Martin-Thom e<sup>10</sup>, Catherine Chirouze<sup>11</sup>, Pierre Tattevin<sup>12</sup>, Christophe Strady<sup>13</sup>, Nelly Agrinier<sup>14</sup>, Francois Alla<sup>15, 16</sup>, Bernard Jung<sup>17</sup>, Christine Selton-Suty<sup>18</sup>, Bruno Hoen<sup>19,#,\*</sup>, Xavier Duval<sup>20, 21, 22, 23,#</sup> for the EI-dents Association pour l'Etude et la Pr evention de l'Endocardite Infectieuse (AEPEI) Study Group

<sup>1</sup>CHRU Nancy, Service Odontologie, F-54000 Nancy, France

<sup>2</sup>Facult e d'Odontologie, Universit e de Lorraine, F-54000 Nancy, France

<sup>3</sup>Universit e de Lorraine, CNRS, IMoPA, F-54000 Nancy, France

<sup>4</sup>Service de chirurgie orale, Montpellier, Centre hospitalier universitaire de Montpellier, 34295 Montpellier, France

<sup>5</sup>INSERM, UMR 1149/ERL CNRS 8252, Centre de Recherches sur l'inflammation, Universit e de Paris, Paris 75018, France

<sup>6</sup>CHRU-Nancy, INSERM, Universit e de Lorraine, CIC, Epid miologie Clinique, F-54000 Nancy, France

<sup>7</sup>Service de Chirurgie Maxillo-Faciale, de Stomatologie et d'Odontologie (Head: Pr Christophe Meyer), Centre hospitalier Universitaire de Besan on, F-25000 Besan on, France

<sup>8</sup>EA 4662, Laboratoire Nanom decine, Imagerie et Th rapeutique (LNIT) (Head : Pr Fr d ric Auber), Universit e de Franche-Comt e, F-25000 Besan on, France

<sup>9</sup>Private practice, Clinique Courlancy, Reims, France

<sup>10</sup>Private practice, Maison des consultations de l'h pital priv e, S evign e, France

<sup>11</sup>UMR 6249 Chrono-Environnement, CNRS - Universit e de Franche-Comt e, France ; service de maladies infectieuses et tropicales, CHRU Besan on, France

<sup>12</sup>Service des Maladies Infectieuses et R animation M dicale, H pital Pontchaillou, CHU Rennes, France

<sup>13</sup>Cabinet d'infectiologie, Clinique Saint Andr e-Groupe Courlancy, 51100 Reims, France

<sup>14</sup>CHRU Nancy, Inserm, Université de Lorraine, CIC, Epidémiologie clinique, F-54000, Nancy, France

<sup>15</sup>Centre de recherche Bordeaux Population Health, UMR 1219, CIC-EC 1401, Université de Bordeaux, Bordeaux, France

<sup>16</sup>Service de Prévention, CHU, Bordeaux, France

<sup>17</sup>Bichat Hospital APHP, Université de Paris, Paris, France

<sup>18</sup>Service de Cardiologie, CHRU, Nancy, France

<sup>19</sup>Institut Pasteur, Centre de Recherche Translationnelle, 25-28 rue du Docteur Roux, 75724 Paris Cedex 15, France

<sup>20</sup>Inserm CIC 1425, Paris, France

<sup>21</sup>AP-HP, University Hospital of Bichat, Paris, France

<sup>22</sup>Inserm UMR-1137 IAME, Paris, France

<sup>23</sup>University Paris Diderot, Paris 7, UFR de Médecine-Bichat, Paris, France

<sup>#</sup>Both authors contributed equally to this work

<sup>\*</sup>**Corresponding author:** Bruno Hoen. Institut Pasteur, Centre de Recherche Translationnelle, 25-28 rue du Docteur Roux, 75724 Paris Cedex 15, France. E-mail: [bruno@hoen.pro](mailto:bruno@hoen.pro)

**Graphical abstract**

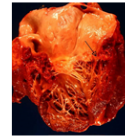
**Poor oral health and hygiene habits in patients with infective endocarditis and previously identified predisposing cardiac condition: a prospective cohort study.**

**A Case-Control Study**

**Population**  
323 patients with definite Infective Endocarditis (IE)



**The PCC+ group**  
(patients with previously identified IE-predisposing cardiac conditions (PCC))  
(n=173, 53.6% of the whole population)



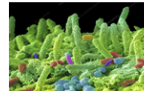
**The PCC- group**  
(patients without previously identified IE-PCC)  
(n=150, 46.4% of the whole population)

**Results**

Neither oral status nor self-reported hygiene were different between PCC+ and PCC- patients



Oral pathogens caused IE more frequently in PCC+ than in PCC- patients (44.6% vs. 33.6%,  $P=0.046$ )



A dental consultation in the prior two years was reported more often in PCC+ than in PCC- patients (70.4% vs. 56.3%,  $P=0.025$ )



**Conclusion**

IE patients with previously identified cardiac condition at risk of IE have suboptimal oral health and hygiene habits. Recommendations for oral hygiene are poorly followed among patients at risk of IE. A multidisciplinary approach of the follow-up of those patients, combining systematic dental and cardiological examinations once or twice a year depending on the underlying heart disease, should be implemented to improve oral health and hygiene in the prevention of IE.

Moby V, Millot S, Erpelding ML, Euvrard E, Bourgeois G, Martin-Thomé H *et al.*, 2022

**Highlights**

- Oral health and hygiene are suboptimal in patients with pre-identified risk of IE.
- 45% of the IE that developed in patients at risk of IE were due to oral pathogens.
- There is a clear need to improve oral health of patients at risk of IE.

*To the editor*

Robertson and colleagues, in this Journal, recently highlighted a general trend in decreasing dental and oral health, as shown by a significant increase in hospital admissions for the management of severe dental infection in England [1]. Guidelines on prophylaxis of infective endocarditis (IE) recommend that patients with previously identified IE-predisposing cardiac condition (PCC) maintain a strict oral hygiene and undergo regular professional dental follow-up [2]. Recently, Duval et al. reported that the lack of oral hygiene was the predominant factor that contributes to the development of oral streptococcal IE [3]. However, information is missing on compared oral health and hygiene habits in IE patients with previously identified IE-PCC (PCC+ patients, a population theoretically aware of IE prophylaxis) and in those with no IE-PCC (PCC- patients).

We evaluated oral health status, assessed by standardised clinical and radiological examinations of teeth, in 323 patients with definite IE enrolled in a prospective cohort study. The Decayed, Missing

and Filled Teeth (DMFT) index was determined for each subject to estimate the global health oral status. This index is well established as a key measure of clinical examination for caries, filled and missing teeth [4]. Among IE-causing microorganisms, a group of oral pathogens was assembled (see Supplementary data S2). Oral hygiene habits and history of dental visits were recorded using a self-administered questionnaire.

Patients were divided into two groups based on the European Society of Cardiology guidelines for IE: (1) the PCC+ group combining patients at high-risk of IE (i.e., patients with prosthetic heart valve, cyanotic congenital heart disease, and/or history of IE) or intermediate risk of IE (i.e., patients with other previously identified PCC at risk of IE); and (2) the PCC- group of patients for whom no specific preventive measures were indicated (Flow chart in Supplementary data S1).

Comparisons between PCC+ and PCC- patients were performed with Student t-tests and Chi 2 tests if applicable, otherwise nonparametric Wilcoxon and Fisher exact tests. All statistical analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NY) software.

The IE causative microorganism, the oral status are reported by groups in Table 1. Oral hygiene habits and history of dental visits are presented in Table 2. Oral pathogens caused IE more frequently in PCC+ than in PCC- patients (44.6% vs. 33.6%,  $P=0.046$ ). Neither oral status nor self-reported hygiene were different between PCC+ and PCC- patients (calculus, 41.1% vs. 35.8%; periodontal disease, 32.9% vs. 31.1%; dental abscesses, 23.5% vs. 32.0%; caries, 52.3% vs. 54.8%; DMFT index,  $14.9\pm 7.5$  vs.  $15.6\pm 7.8$ ; twice-daily toothbrushing, 58.2% vs. 51.2%; toothbrushing after meals, 55.7% vs. 54.3%; flossing, 9% vs. 7.2%; interdental brushing, 9.8% vs. 10.6%, respectively). A dental consultation in the prior two years was reported more often in PCC+ than in PCC- patients (70.4% vs. 56.3%,  $P=0.025$ ).

Oral status were suboptimal in our study population and did not differ between the two groups. First, about one third of PCC+ patients presented periodontal infectious foci. This is of concern since the presence of periodontal diseases promotes local inflammation, induces bacteraemia and potentially IE [5]. Second, about one quarter of patients exhibited at least one endodontic apical lesion, which is regarded as a focus of infection [6]. Third, 50% of PCC+ patients had active caries, which is also a focus of infection [7]. The DMFT index was not significantly different between the two groups of patients. This lack of differences between patients with and without PCC at risk of IE reflects that there is a need for a better oral care in patients at risk of IE. To our knowledge, this is the first time that DMFT index was used in the assessment of oral health status in IE patients. The use of DMFT index could be repeated in the individual follow-up of patients' oral health status.

Self-reported oral hygiene habits were not different between groups either. As it is essential to diminish the occurrence of spontaneous bacteraemia at risk of inducing IE, PCC+ patients are supposed to receive advice to maintain optimal oral hygiene and regular dental follow-up. Only half of

the patients reported to brush their teeth after meal. Moreover, the presence of calculus deposits was detected frequently. This could result from the absence of interdental hygiene or from the use of an inappropriate toothbrushing technique. All patients in the study had very low levels of interdental hygiene. Toothbrushing in the presence of poor oral hygiene and periodontal disease maximises the risk of IE [8]. Furthermore, one third of patients used toothpicks, a traumatic cleaning habit that can provoke bacteraemia-inducing bleeding [9] and is not recommended particularly in patients with PCC.

The poor oral condition of IE patients with or without PCC is in line with their poor oral habits. However, this study does not allow an appreciation to what extent the group of patients with IE and PCC that we explored in this study is representative of the whole population of subjects with PCC in terms of oral status and hygiene. It could even be hypothesised that these patients developed IE because of poorer oral status and/or poorer compliance to hygiene recommendations as compared to subjects with PCC who did not develop IE.

In conclusion, this study shows that patients with previously identified cardiac condition at risk of IE who develop IE have suboptimal oral health and hygiene habits. Among the IE patients we evaluated in this study, those with PCC were expected to be informed about the importance of oral health but did not have a better oral status than PCC- patients and seem to weakly adhere to optimal oral hygiene measures and dental care. Thus, further interventions should be implemented to improve oral health and hygiene in the prevention of IE. This should be achieved through a multidisciplinary approach of the follow-up of those patients, combining systematic dental and cardiological examinations once or twice a year depending on the underlying heart disease. Studies to understand why patients previously identified with cardiac condition at risk of IE do not follow hygiene recommendations and have such poor dental status should also be considered.

### **Financial support**

This work was supported by the French Ministry of Health; Société Française de Cardiologie; and Fédération Française de Cardiologie (grant 2009); Inserm XM/GB/2009–051

### **Acknowledgments**

We thank all study participants and all the members of the EI-dent AEPEI Study Group.

### **Declaration of Competing Interest**

The authors declared no conflict of interests.

## References

1. Robertson DD, Smith AJ. Significant increase in hospital admissions for the management of severe dental infection in England 2000-2020. *J Infect* 2021;**83**(4):499–501. doi: 10.1016/j.jinf.2021.07.009
2. Habib G, Lancellotti P, Antunes MJ, Grazia Bongiorno M, Casalta JP, Del Zotti F, *et al.* 2015 ESC Guidelines for the management of infective endocarditis: The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM). *Eur Heart J* 2015;**36**:3075–128. doi:10.1093/eurheartj/ehv319
3. Duval X, Millot S, Chirouze C, Seton-Sulty C, Moby V, Tattevin P, *et al.* Oral Streptococcal Endocarditis, Oral Hygiene Habits, and Recent Dental Procedures: A Case-Control Study. *Clin Infect Dis* 2017;**64**:1678–85. doi:10.1093/cid/cix237
4. Larmas M. Has dental caries prevalence some connection with caries index values in adults? *Caries Res* 2010;**44**:81–4. doi:10.1159/000279327
5. Carinci F, Martinelli M, Contaldo M, Santoro R, Pezzetti F, Lauritano D, *et al.* Focus on periodontal disease and development of endocarditis. *J Biol Regul Homeost Agents* 2018;**32**:143–7.
6. Saber MH, Schwarzberg K, Alonaizan FA, Kelley ST, Sedghizadeh PP, Furlan M, *et al.* Bacterial flora of dental periradicular lesions analyzed by the 454-pyrosequencing technology. *J Endod* 2012;**38**:1484–8. doi:10.1016/j.joen.2012.06.037
7. Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, *et al.* Dental caries. *Nat Rev Dis Primer* 2017;**3**:17030. doi:10.1038/nrdp.2017.30
8. Mougéot FKB, Saunders SE, Brennan MT, Lockhart PB. Associations between bacteremia from oral sources and distant-site infections: tooth brushing versus single tooth extraction. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2015;**119**:430–5. doi:10.1016/j.oooo.2015.01.009
9. Lockhart PB, Brennan MT, Sasser HC, Fox PC, Paster BJ, Bahrani-Mougéot FK. Bacteremia associated with toothbrushing and dental extraction. *Circulation* 2008;**117**:3118–25. doi:10.1161/CIRCULATIONAHA.107.758524

**Table 1: Oro-dental status according to the presence of previously identified infective endocarditis predisposing cardiac conditions in 323 patients hospitalised for definite IE**

	Total population		Patients with previously identified infective endocarditis-predisposing cardiac conditions (PCC+ patients)		Patients without previously identified infective endocarditis-predisposing cardiac conditions (PCC- patients)		p
	323		173 (53.6%)		150 (46.4%)		
	N	%	N	%	N	%	
<b>Periodontal status</b>							
Presence of calculus							0.591
Yes	103	38.7	60	41.1	43	35.8	
No	146	54.9	76	52.1	70	58.3	
Edentulous	17	6.4	10	6.8	7	5.8	
Unknown	57		27		30		
Radiological periodontal disease							0.760
Yes	87	32.1	49	32.9	38	31.1	
No	184	67.9	100	67.1	84	68.9	
Unknown	52		24		28		
Periodontal pocket depth of 4mm or more							0.181
Yes	74	29.2	34	24.5	40	35.1	
No	162	64.0	95	68.3	67	58.8	
Edentulous	17	6.7	10	7.2	7	6.1	
Unknown	70		34		36		
<b>Endodontic status</b>							
Pulpal necrosis							0.277
Yes	13	4.8	9	6.0	4	3.2	
No	260	95.2	140	94.0	120	96.8	
Unknown	50		24		26		
Apical or periapical focus of infection							0.119
Yes	74	27.3	35	23.5	39	32.0	
No	197	72.7	114	76.5	83	68.0	
Unknown	52		24		28		
Sub-optimal root canal treatment							0.785
Yes	102	37.6	55	36.9	47	38.5	
No	169	62.4	94	63.1	75	61.5	
Unknown	52		24		28		
<b>Dental status</b>							
Dental caries							0.681
Yes	146	53.5	78	52.3	68	54.8	
No	127	46.5	71	47.7	56	45.2	
Unknown	50		24		26		
<b>Global health oral status</b>							
DMFT index							
Mean DMFT (Mean±SD)	216	15.2 (7.6)	118	14.9 (7.5)	98	15.6 (7.8)	0.523
Mean DT index (Mean±SD)	256	2.5 (3.7)	139	2.1 (3.0)	117	3.1 (4.3)	0.247
Mean MT index (Mean±SD)	216	8.0 (7.9)	118	7.7 (8.2)	98	8.3 (7.5)	0.563
Mean FT index (Mean±SD)	256	5.1 (4.9)	139	5.5 (5.1)	117	4.6 (4.6)	0.164
<b>Causative microorganisms</b>							
Oral pathogens*	123	39.4	74	44.6	49	33.6	<b>0.046</b>

DMFT=Decayed, Missing and Filled Teeth; DT/MT/FT=Decayed/Missing/Filled Teeth

\* see Supplementary data S2 for the pathogen list



**Table 2: Oral health habits according to the presence of previously identified infective endocarditis predisposing cardiac conditions in 323 patients hospitalised for definite IE**

	Total population		Patients with previously identified infective endocarditis-predisposing cardiac conditions (PCC+ patients)		Patients without previously identified infective endocarditis-predisposing cardiac conditions (PCC- patients)		p
	N	%	N	%	N	%	
	323		173 (53.6%)		150 (46.4%)		
<b>Self-reported oral hygiene</b>							
<b>Toothbrushing frequency</b>							<b>0.572</b>
Twice daily or more	148	55.0	85	58.2	63	51.2	
Once daily	78	29.0	39	26.7	39	31.7	
Less than once daily	26	9.7	12	8.2	14	11.4	
Edentulous	17	6.3	10	6.8	7	5.7	
Unknown	54		27		27		
<b>Toothbrushing after meal</b>							<b>0.841</b>
Yes	153	55.0	83	55.7	70	54.3	
No	108	38.8	56	37.6	52	40.3	
Edentulous	17	6.1	10	6.7	7	5.4	
Unknown	45		24		21		
<b>Interdental hygiene</b>							
<b>Toothpicks</b>							<b>0.871</b>
Yes	80	30.1	42	29.0	38	31.4	
No	169	63.5	93	64.1	76	62.8	
Edentulous	17	6.4	10	6.9	7	5.8	
Unknown	57		28		29		
<b>Flossing</b>							<b>0.775</b>
Yes	22	8.1	13	9.0	9	7.2	
No	231	85.6	122	84.1	109	87.2	
Edentulous	17	6.3	10	6.9	7	5.6	
Unknown	53		28		25		
<b>Interdental brush</b>							<b>0.897</b>
Yes	27	10.2	14	9.8	13	10.6	
No	222	83.5	119	83.2	103	83.7	
Edentulous	17	6.4	10	7.0	7	5.7	
Unknown	57		30		27		
<b>Dental history</b>							
<b>Last dental visit &lt; 2 years</b>							<b>0.025</b>
Yes	162	63.8	95	70.4	67	56.3	
No	75	29.5	30	22.2	45	37.8	
Edentulous	17	6.7	10	7.4	7	5.9	
Unknown	69		38		31		