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PAPER

Impact of systemic lupus erythematosus on oral health-related quality of life

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Oral symptoms in systemic lupus erythematosus (SLE) patients are often unexplored and affect the health-related quality of life. The aims of this study were: (a) to evaluate the oral health condition of SLE patients compared to control subjects without rheumatic diseases; (b) to determine the consequences of oral health condition in the quality of life of these two groups. Individuals with SLE ($n = 75$) and without SLE ($n = 78$) (control group), paired for gender and age, underwent complete oral examination. Sociodemographic and clinical information was obtained, and interviews were conducted using the Brazilian version of the oral health impact profile. The activity and damage of SLE disease were assessed, respectively, by the systemic lupus erythematosus disease activity index 2000 and the Systemic Lupus International Collaborating Clinics/American College of Rheumatology damage index for systemic lupus erythematosus. When we analysed the oral health condition and hygiene habits of the participants, SLE patients exhibited an increased number of missing teeth despite their higher frequency of tooth brushing. No significant differences were verified in other habits and clinical parameters evaluated such as smoking, flossing, salivary flux, periodontitis, decayed and filled teeth. Patients with SLE presented with worse oral health-related quality of life than controls ($P = 0.011$). The significant difference was on individuals' physical disability ($P = 0.002$). The determinant of the negative impact on the oral health-related quality of life was prosthesis wearing ($P < 0.05$). Overall, the oral health impact profile score was higher in individuals with moderate SLE damage compared to SLE individuals with no damage ($P = 0.043$). Patients with SLE had a negative impact of oral condition on their quality of life. The evaluation of the oral health-related quality of life might be useful to monitor the effects of SLE on oral condition. *Lupus* (2017) **0,** 1–7.

Key words: Systemic lupus erythematosus; oral health; quality of life

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune, chronic inflammatory disease, with an estimated incidence of 8.7 per 100,000 individuals each year in Brazil.[1] SLE clinical manifestations affect skin, joints, kidneys, lungs, nervous system and other organs.[2] Furthermore, most SLE patients suffer from oral complaints such as dryness, soreness, oral ulcers, mucositis, glossitis and periodontal disease.[3–5] These oral symptoms may influence the appearance and interpersonal relationships, with reflections on economic, social and psychological aspects of the patients, leading to impairment of quality of life.[6]

Health-related quality of life (HRQoL) is generally poorer in patients with SLE than in the general population.[7] Several studies have shown that patients' HRQoL depends on treatment efficacy and on psychosocial factors such as quality of social relationships.[7,8] The oral health impact profile (OHIP) was introduced to measure subjects' perceptions of the social impact of oral disorders on their wellbeing.[9] There is little

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information about the oral health-related quality of life (OHRQoL) among individuals with rheumatic diseases,[6,10,11] with no data regarding SLE. Thus, the aims of this study were: (a) to evaluate the oral health condition of SLE patients compared to control subjects without rheumatic diseases; (b) to determine the consequences of oral health condition in the quality of life of these two groups.

Methods

Participants, setting, period of recruitment and eligibility criteria

The present cross-sectional study was conducted in Belo Horizonte, Brazil, between 2013 and 2014. SLE patients with a regular follow-up at the Rheumatology Outpatient Clinic of the Medical School Hospital of Universidade Federal de Minas Gerais were included in this study ($n = 75$). The control group ($n = 75$) consisted of subjects without known rheumatic diseases, randomly assigned from a population of workers of the public health services or family and friends of SLE patients, with demographic, social and educational backgrounds similar to the SLE group. The exclusion criteria were: use of any medication with the exception of oral contraceptives, those who had been submitted to any dental treatment within the last 6 months or had used antibiotics in the last 3 months.

The eligibility criteria for inclusion in the SLE group were as follows: age 18 years or greater; diagnosis of SLE and the presence of at least eight teeth. Individuals with other rheumatic diseases, except for secondary Sjögren's syndrome; those who had been submitted to any dental treatment within the last 6 months; individuals with chronic renal insufficiency requiring dialysis or kidney transplantation; acute or chronic infectious conditions at the time of the study; diagnosis of neoplasia within the last 5 years; pregnant individuals and those during breastfeeding were excluded.

The sample power calculation was performed using the power and sample size calculation program (PS, version 3.0; Nashville, TN, USA). When analysing means and standard deviations of overall OHIP scores for the SLE group and the control group, the true difference in the mean values between the SLE group and control group was 20.52 and the standard deviation was 40.18. The null hypothesis that the mean values of the SLE group and the control group were equal was rejected with a power of 87.5%. This means that the statistical power with our sample size was higher than 80%.

Ethical issues

The present study was approved by the Ethics Committee on Human Research of the Universidade Federal de Minas Gerais (UFMG) (protocol number CAAE 03128012.0.0000.5149/2012). Individuals were asked regarding their willingness to participate or otherwise. If they agreed to participate, a written informed consent form was signed.

Assessment of SLE disease activity and disease damage

Medical records of SLE patients were reviewed in order to collect information about the disease. Disease activity was established according to the systemic lupus erythematosus disease activity index 2000 (SLEDAI 2k).[12] Disease damage was classified using the Systemic Lupus International Collaborating Clinics/American College of Rheumatology damage index for SLE (SDI). This tool evaluates non-reversible cumulative damage in 12 domains according to the organ system involved.[13] It was categorised as follows: SDI score equal to 0 denotes no damage; SDI score of 1 to 3 indicates moderate damage and SDI score higher than 3 denotes severe damage.[14]

OHRQoL evaluation instrument

The dependent variable assessed was the OHRQoL of individuals with SLE and controls. Data were collected through the long form of the oral health impact profile (OHIP-49),[15] which was developed in Australia and cross-culturally adapted for use in the Brazilian population.[16] The OHIP-49 consists of 49 questions distributed across seven subscales: functional limitation (nine items), physical pain (nine items), psychological discomfort (five items), physical disability (nine items), psychological disability (six items), social disability (five items) and handicap (six items). Each question has five response options: 'never' 0, 'hardly ever' 1, 'sometimes' 2, 'fairly often' 3, 'very often' 4. The overall score is obtained by adding up the scores of the 49 questions and ranges from 0 to 196. Scores for each of the seven subscales can also be obtained independently. Superior scores denote higher negative impact on individuals' OHRQoL.

Assessment of oral outcomes

Dental caries were diagnosed using the decayed, missing and filled teeth index according to the World Health Organization.[17] Both groups were submitted to periodontal examination of the full mouth using a periodontal probe (Hu-Friedy, PCP 15; North Carolina University, Chicago, IL, USA). Two trained and calibrated examiners (JDC and SMSM) performed the periodontal examination. Periodontitis was defined as two or more interproximal sites with clinical attachment level (CAL) of 3 mm or greater, and two or more interproximal sites with probing depth (PD) of 4 mm or greater (not on same tooth) or one site with PD of 5 mm or greater.[18]

For sialometry assessment, participants were asked to stay 30 minutes without eating or drinking. For unstimulated sialometry, participants were instructed to spit the saliva that accumulated in the mouth for 5 minutes in a tube. For stimulated sialometry, the procedure was similar and participants were instructed to chew a mechanic sialogogue during saliva collection.

Sociodemographic and oral hygiene variables

The following sociodemographic and oral hygiene variables were collected: gender, age ($\leq$39 years; >39 years), schooling ($\leq$10 years of education; $\geq$11 years of education), smoking (no; yes), toothbrushing ($\leq$2 times/day; $\geq$3 times/day) and flossing (<1 times/day; $\geq$1 times/day). Family income was evaluated in terms of the Brazilian monthly minimum wage (BMMW) which corresponded to US$300.00 at the time of the study and was defined as the income of all economically active members of that family ($\leq$1 BMMW; >1 BMMWs $\leq$3; >3 BMMWs $\leq$5; >5 BMMWs).

Statistical analysis

Statistical analysis was carried out using the statistical package for the social sciences software (SPSS for Windows, version 22.0; SPSS, Chicago, IL, USA). Descriptive analysis was performed. The responses to categorical questions for each group were compared using the chi-square test. The responses to continuous variables for each group were compared using the Mann–Whitney test. The Mann–Whitney test was also used to evaluate differences in the subscale and overall OHIP scores between the SLE group and the control group and between the different SLEDAI 2K SDI categories in the SLE group. For the overall score, the level of significance was set at $P < 0.05$. For the subscales, the Bonferroni correction was used and P values less than 0.007 were considered statistically significant.

Finally, multivariable linear regression analysing the OHRQoL of participants of both groups was carried out. The clinical variables along with the sociodemographic and the oral behaviour variables were incorporated into the model. The sociodemographic and oral behaviour variables were incorporated into the model based on statistical significance ($P < 0.20$). For the final model, the level of significance was set at 5% ($P < 0.05$).

Results

Table 1 shows the demographic and socioeconomic characteristics of participants. The gender distribution was similar in both groups. The mean age for individuals of the SLE group was 38.03 years ($\pm$9.80) and for individuals of the control group it was 41.31 years ($\pm$14.20). The level of education and the family income were not different between SLE and control subjects.

When we analysed the oral condition and hygiene habits of the participants, we found that SLE patients exhibited an increased number of missing teeth despite their higher frequency of tooth brushing (Table 2). No significant differences were verified in habits such as smoking or flossing frequency. Similar clinical parameters such as prosthesis wearing, decayed teeth, filled teeth or periodontitis were detected comparing the two groups.

Table 1 Sociodemographic characteristics of participants of the SLE and control groups

	SLE, N *(%)*	*Control,* N *(%)*	P *value*
Gender			
Female	68 (90.7)	62 (79.5)	0.053[a]
Male	07 (9.3)	16 (20.5)	
Age (years)			
$\leq$39	46 (61.3)	35 (44.9)	0.041[a]
>39	29 (38.7)	43 (55.1)	
Schooling (years of education)			
$\leq$10	26 (34.7)	22 (28.2)	0.389[a]
$\geq$11	49 (65.3)	56 (71.8)	
Family income (BMMW)			
$\leq$1 BMMW	08 (10.7)	06 (7.7)	0.356[a]
>1 BMMWs $\leq$3	44 (58.7)	41 (52.6)	
>3 BMMWs $\leq$5	18 (24.0)	19 (24.4)	
>5 BMMWs	05 (6.6)	12 (15.3)	

SLE: systemic lupus erythematosus; BMMW: Brazilian monthly minimum wage.
[a]Chi-square test.

Table 2 Oral behaviours and clinical variables of participants of the SLE group and the control group

	SLE, N *(%)*	*Control,* N *(%)*	P *value*
Smoking			
No	59 (78.7)	58 (74.4)	0.530[b]
Yes	16 (21.3)	20 (25.6)	
Tooth-brushing			
≤2 times/day	16 (21.3)	33 (42.3)	**0.005[b]**
≥3 times/day	59 (78.7)	45 (57.7)	
Flossing			
<1 times/day	26 (34.7)	33 (42.3)	0.332[b]
≥1 times/day	49 (65.3)	45 (57.7)	
Prothesis wearing			
No	61 (81.3)	59 (75.6)	0.392[b]
Yes	14 (18.7)	19 (24.3)	
Sialometry (unstimulated)			
≤0.3 ml/min	09 (12.0)	03 (3.8)	0.064[b]
≥0.4 ml/min	66 (88.0)	74 (96.2)	
Sialometry (stimulated)			
<1.5 ml/min	23 (30.7)	21 (27.6)	0.682[b]
≥1.5 ml/min	52 (69.3)	55 (72.3)	
DMFT	13.65 (6.48)[a]	15.14 (7.40)[a]	0.160[c]
Decayed teeth	1.76 (2.71)[a]	0.63 (0.95)[a]	**0.013[c]**
Missing teeth	3.73 (3.85)[a]	4.09 (4.63)[a]	0.997[c]
Filled teeth	8.33 (5.34)[a]	9.36 (5.53)[a]	0.273[c]
Periodontitis			
No	24 (32.0)	37 (47.4)	0.051[b]
Yes	51 (68.0)	41 (52.6)	

SLE: systemic lupus erythematosus; DMFT: decayed, missing, filled tooth.
[a]Mean (standard deviation).
[b]Chi-square test.
[c]Mann–Whitney test.

Unstimulated salivary flux was slightly diminished in SLE patients but no significance was observed (Table 2). It is important to mention that none of the SLE patients reported the use of any saliva substitute or stimulant.

Table 3 displays the results of the comparison of OHRQoL between the SLE and control groups. The individuals of the SLE group presented with a higher OHIP overall score compared to the individuals of the control group ($P = 0.011$). Therefore, the OHRQoL was more deteriorated among individuals of the SLE group. The significant domain affected was individuals' physical disability (physical disability subscale, $P = 0.002$).

Table 4 presents the comparison of OHRQoL between the different categories of SLEDAI 2K and SDI in the SLE group. Individuals with a moderate damage (SDI score of 1–3) had a worse OHRQoL, demonstrated by a significant higher overall OHIP score than individuals with no damage (SDI score equal to 0) ($P = 0.043$). Comparing SLE patients with different scores of

Table 3 Comparison of oral health-related quality of life between the SLE group and the control group

	SLE Median (mode)	*Control Median (mode)*	P *value*
Function limitation	14.0 (0)	9.00 (0)	0.022[a]
Physical pain	12.0 (0)	9.00 (0)	0.033[a]
Psychological discomfort	8.0 (0)	2.00 (0)	0.015[a]
Physical disability	4.0 (0)	1.00 (0)	**0.002[a]**
Psychological disability	3.0 (0)	0.00 (0)	0.020[a]
Social disability	0.00 (0)	0.00 (0)	0.014[a]
Handicap	0.00 (0)	0.00 (0)	0.018[a]
Overall score	43.00 (0)	22.00 (0)	**0.011[b]**

SLE: systemic lupus erythematosus.
[a]Bonferroni correction; significant at the level $P < 0.007$.
[b]Mann–Whitney test; significant at the level $P < 0.05$.

disease activity (SLEDAI) no significant differences of OHRQoL were detected ($P > 0.05$).

Table 5 shows the findings of the multivariable linear regression for individuals with SLE and for individuals of the control group. In multivariate regression, the only predictor of worse OHRQoL was prosthesis wearing ($P < 0.05$) in the SLE group.

Discussion

To our knowledge, this is the first study assessing the effect of oral conditions on SLE patients' quality of life. The main findings of this study are: (a) SLE patients presented with worse OHRQoL than controls with the main impact upon individuals' physical disability; (b) prosthesis wearing was independently associated with worse OHRQoL; (c) the comparison among SDI categories showed that SLE patients with moderate damage had worse OHRQoL than those with no damage.

Chronic diseases such as SLE affect not only patients' physical health, but also their behaviour, social and psychological aspects.[19] Therefore, it is important to consider disease activity and damage as well as subjective parameters, such as the HRQoL, during the follow-up of affected individuals. HRQoL is a measure of a patient's physical and functional health.[20] Studies have reported that SLE patients have a reduced HRQoL comparable to their counterparts with severe medical diseases, such as AIDS, rheumatoid arthritis and diabetes.[19–21] As poor quality of life is a determinant of reduced treatment compliance,[7] the 2010 European League Against Rheumatism guidelines for monitoring patients with SLE recommended

Table 4 Median (mode) of overall and subscale OHIP scores according to SLEDAI and SDI categories

	Function limitation Median (mode)	*Physical pain Median (mode)*	*Psychological discomfort Median (mode)*	*Physical disability Median (mode)*	*Psychological disability Median (mode)*	*Social disability Median (mode)*	*Handicap Median (mode)*	*Overall score Median (mode)*
SLEDAI								
0	15.0 (16)	12.5 (9)	7.0 (0)	4.0 (0)	3.0 (0)	0.0 (0)	0.5 (0)	39.0 (17)
1	13.0 (0)	12.5 (0)	9.0 (0)	3.0 (0)	3.5 (0)	0.0 (0)	0.0 (0)	41.0 (0)
P value[a]	0.809	0.733	0.638	0.394	0.873	0.619	0.407	0.998
SLEDAI								
0	15.0 (16)	12.5 (9)	7.0 (0)	4.0 (0)	3.0 (0)	0.0 (0)	0.5 (0)	39.0 (17)
2	16.0 (2)	12.0 (0)	6.0 (0)	7.0 (0)	0.0 (0)	0.0 (0)	2.0 (0)	50.0 (2)
P value[a]	0.961	0.921	0.634	0.392	0.496	0.664	0.468	0.98
SDI								
0	12.0 (0)	12.0 (0)	4.0 (0)	3.0 (0)	1.0 (0)	0.0 (0)	0.0 (0)	**40.0 (2)**
1	15.0 (16)	13.0 (3)	10.0 (20)	4.0 (0)	8.0 (0)	0.0 (0)	1.0 (0)	**53.0 (17)**
P value[a]	0.094	0.238	0.041	0.287	0.043	0.055	0.112	**0.043**
SDI								
0	12.0 (0)	12.0 (0)	4.0 (0)	3.0 (0)	1.0 (0)	0.0 (0)	0.0 (0)	40.0 (2)
2	13.0 (13)	4.0 (18)	9.0 (0)	4.0 (0)	4.0 (0)	0.0 (0)	0.0 (0)	25.0 (3)
P value[a]	0.842	0.818	0.368	0.604	0.385	0.548	0.815	0.668

[a]Mann–Whitney test.
For the subscales, Bonferroni correction was applied; significant at the level $P < 0.007$.
For the overall score, significant at the level $P < 0.05$.
OHIP: oral health impact profile; SLEDAI: systemic lupus erythematosus disease activity index; SDI: Systemic Lupus International Collaborating Clinics/American College of Rheumatology damage index for systemic lupus erythematosus.
SLEDAI 0: no disease activity; SLEDAI 1: moderate disease activity; SLEDAI 2: severe disease activity.
SDI 0: no damage; SDI 1: moderate damage; SDI 2: severe damage.

Table 5 Linear regression model evaluating the impact of oral conditions on the quality of life of individuals of SLE and the control group

	SLE group		*Control group*	
	β coefficient	*Standard error*	*β coefficient*	*Standard error*
Gender				
Female; male	0.070	17.55	–0.155	9.21
Age (years)				
≤39; >39	0.214	13.11	–0.031	9.64
Toothbrushing				
≤2 times/day; ≥3 times/day	0.008	13.61	–0.157	7.58
Sialometry (unstimulated)				
≤0.3 ml/min; ≥0.4 ml/min	0.009	19.49	–0.020	19.30
Sialometry (stimulated)				
<1.5 ml/min; ≥1.5 ml/min	–0.092	12.79	0.09	8.34
Prothesis wearing				
No; Yes	**–0.300**	**16.86[a]**	–0.048	11.69
DMFT				
Decayed teeth	–0.407	5.88	–0.053	0.88
Missing teeth	0.438	6.17	0.206	3.94
Filled teeth	0.541	6.37	0.282	1.35
Periodontitis	0.577	6.04	0.229	1.00
No; Yes	0.122	12.29	0.114	8.46

[a]$P < 0.05$.
SLE: systemic lupus erythematosus; DMFT: decayed, missing, filled teeth.

that HRQoL should be assessed at every scheduled appointment.[22]

Oral health is an essential part of general health and significantly influences individuals' quality of life. The OHIP-49 is a questionnaire that evaluates dysfunction, discomfort and disability attributed to oral conditions.[16] In this study the OHIP-49 was used and the data obtained showed that SLE patients presented with worse OHRQoL. Similar results have been shown for patients with other rheumatic diseases such as Sjögren's syndrome, fibromyalgia, rheumatoid arthritis and systemic sclerosis.[6,11]

The domain of OHRQoL affected in SLE patients was physical disability and this was probably caused by prosthesis wearing. Previous studies have demonstrated that the need for dental prosthesis or the current use of dental prosthesis produced detrimental effects on OHRQoL.[23,24] Despite the general improvement in OHRQoL shortly after rehabilitation with partial dentures, a long-term opposite effect can be observed. Furthermore, whether prosthesis replaces few teeth or the entire arch of teeth needs observation. One important aspect of our sample was the use of a minimum number of teeth as inclusion criteria, resulting in the exclusion of 62 SLE patients.[5] This fact may

have underestimated the impact of the prosthesis wearing in OHRQoL in our study.

The negative effects on OHRQoL of individuals wearing partial dentures might be explained by the development of dental caries and/or periodontal disease on the remaining teeth over time. Previous studies[25,26] have shown that SLE patients are more affected by periodontitis. Our data demonstrated that SLE patients tended to be more affected by periodontitis, but the difference was not significant. In addition, complications such as ill-fitting, discomfort of the new prosthesis and inflammation of the supported mucosa could have negatively impacted OHRQoL.[27] Regarding function, instability of the prosthesis, problems with speech and a feeling of having something in the mouth also had a negative impact on the patients.[27] Prosthesis wearing can also affect the patients' diet, causing pain when chewing and leading to the avoidance of some kinds of food. These complications may explain the impact on SLE individuals' physical function that was observed in the present study.

Despite the fact that no difference in prosthesis wearing was found between SLE patients and healthy subjects, it seems to disturb SLE patients more. This fact is probably related to the SLE oral symptoms, e.g. hyposalivation.[28] In fact, previous studies have found that about 79% of SLE patients suffered from hyposalivation.[28] Despite no significant changes in sialometry being detected comparing the groups, we observed that unstimulated saliva is very close to the inferior limit in SLE patients. Although sialometry is the best way to diagnose hyposalivation, it does not necessarily reflect the self-reported dry mouth sensation or xerostomia. Thus, an individual may experience xerostomia with or without hyposalivation or experience hyposalivation with or without xerostomia.[29] These aspects should be further explored in SLE patients.

This study presents shortcomings that should be acknowledged. The first regards the cross-sectional design that precludes a statement of causal inferences or the temporal association between the risk factor and the outcome.[30] The second is the population evaluated, SLE patients attending the outpatient clinic of a reference centre, with long-lasting disease, low activity and high SDI scores. However, this strategy of investigating the consequences of SLE on individuals' lives during outpatient visits seems to be more appropriate in the evaluation of a relatively rare disease.[31] For further studies it would be important to include a complete enquiry regarding xerostomia, prosthesis type/quality and experience with wearing dentures by SLE patients.

In conclusion, SLE has a negative impact on the individuals' OHRQoL. As SLE is a complex disease, a wide range of factors regarding its onset and progression remains underappreciated and poorly understood. The OHRQoL might be useful to evaluate the effects of SLE on the oral condition and to monitor the consequences reflected by the impairment in patients' quality of life. The results presented here highlighted that SLE requires an interdisciplinary intervention for its care, with dental assistance and follow-up for patients, to improve the quality of life of the affected population, as the psychosocial aspects may contribute to the complexity of the development and exacerbation of SLE symptoms.

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