Associations Between Oral Health Status and Diabetic Neuropathy in a Large Romanian Cohort of Patients With Diabetes

Anca Jivanescu,[1] Cosmina I. Bondor,[2] Rodica Pop-Busui,[3] Ioan A. Veresiu,[4] Diana I. Sima,[5,6] Daniel-Tudor Cosma,[5] Bogdan Florea,[7] and Norina A. Gavan[8,9]

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Diabetic neuropathy (DN) and periodontal disease (PD) (gingivitis/periodontitis) are two serious chronic complications of diabetes with shared pathogenetic mechanisms (1,2). This cross-sectional study evaluated the association between DN and self-reported oral health (OH) status in a large cohort of Romanian patients with diabetes initially phenotyped in 2012 (3). Among these, patients who agreed to participate were included in the follow-up. The protocol was approved by the Ethics Committee for Scientific Research of the "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania.

OH was assessed using a three-item self-reported questionnaire that included the following questions: "Do you have complete dentures?" (yes/no), "In the last 6 months, how often have you experienced gingival pain?" (never/rarely/often/very often), and "In the last 6 months, how often have you experienced gingival bleeding?" (never/rarely/often/very often). OH was defined as good (no symptoms), average (experienced symptoms rarely), poor (experienced symptoms often/very often), or very poor (complete dentures).

DN was assessed by trained diabetologists using the Michigan Neuropathy Screening Instrument (MNSI), comprising a questionnaire (MNSIq) and a clinical examination (MNSIe) (4,5). Clinical DN was defined as an MNSIe score of $\geq$2.5; symptomatic DN was defined as an MNSIq score of $\geq$4, or $\geq$2 for the reduced version of MNSIq (MNSIq4) (5).

Proportions of different OH categories in patients with and without DN were compared using the χ^2 test for trend. Logistic regression was used to control for age, sex, diabetes duration, and type 2 diabetes in multivariate analysis. Statistical significance was set at 0.05. Analyses were performed using SPSS 15.0 and Epi Info 3.5.3.

Between March and December 2016, 46 diabetologists from 21 cities enrolled 1,978 patients; 1,379 had valid data (age, sex, complete OH questionnaire, MNSIe, and MNSIq). Their mean (SD) age was 64 (10) years, 783 (56.8%) were women, 1,251 (90.7%) had type 2 diabetes, and 797 (57.8%) had clinical DN.

Participants with DN were older (mean [SD] age 66 [9] vs. 61 [11] years; $P < 0.001$) with longer diabetes duration (mean [SD] 13 [7] vs. 11 [5] years; $P < 0.001$) and were more likely to be women (60.7% vs. 54.0%; $P = 0.013$) and to have type 2 diabetes (58.8% vs. 44.8%; $P = 0.033$).

There were 347 (25.2%) patients with very poor OH (complete dentures), 161 (11.7%) with poor OH, 491 (35.6%) with average OH, and 380 (27.6%) with good OH. Patients with very poor OH were older (70 [9] vs. 62 [10] years for patients with poor and average OH and 62 [11] years for patients with good OH; $P < 0.001$) and were more likely to have type 2 diabetes (26.7% vs. 10.5%; $P = 0.005$); those with poor and very poor OH had longer duration of diabetes than those with good OH (13 [7] and 13 [6] vs. 11 [5] years; $P < 0.001$).

Frequency of poorer OH status was higher in participants with clinical and symptomatic DN (Fig. 1). Overall, mean (95% CI) MNSIe and MNSIq scores were higher in patients with poorer OH status: 2.44 (2.23–2.65) and 3.58 (3.29–3.86), respectively, for good OH, 2.98 (2.77–3.19) and 4.92 (4.66–5.18) for average OH, 3.84 (3.47–4.20) and 6.01 (5.55–6.46) for poor OH, and 3.65 (3.40–

[1]*Department of Prosthodontics, Faculty of Dentistry, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania*
[2]*Department of Medical Informatics and Biostatistics, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania*
[3]*Division of Metabolism, Endocrinology & Diabetes, Department of Internal Medicine, University of Michigan, Ann Arbor, MI*
[4]*Department of Diabetes, Nutrition and Metabolic Diseases, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania*
[5]*Clinical Center of Diabetes, Nutrition and Metabolic Diseases, Cluj-Napoca, Romania*
[6]*Department of Public Health, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania*
[7]*Clinic of Podiatry, Cluj-Napoca, Romania*
[8]*WÖRWAG Pharma GmbH & Co. KG Romanian Representative Office, Cluj-Napoca, Romania*
[9]*NeuroDiab Society of Diabetic Neuropathy, Cluj-Napoca, Romania*

Corresponding author: Cosmina I. Bondor, cosmina_ioana@yahoo.com.

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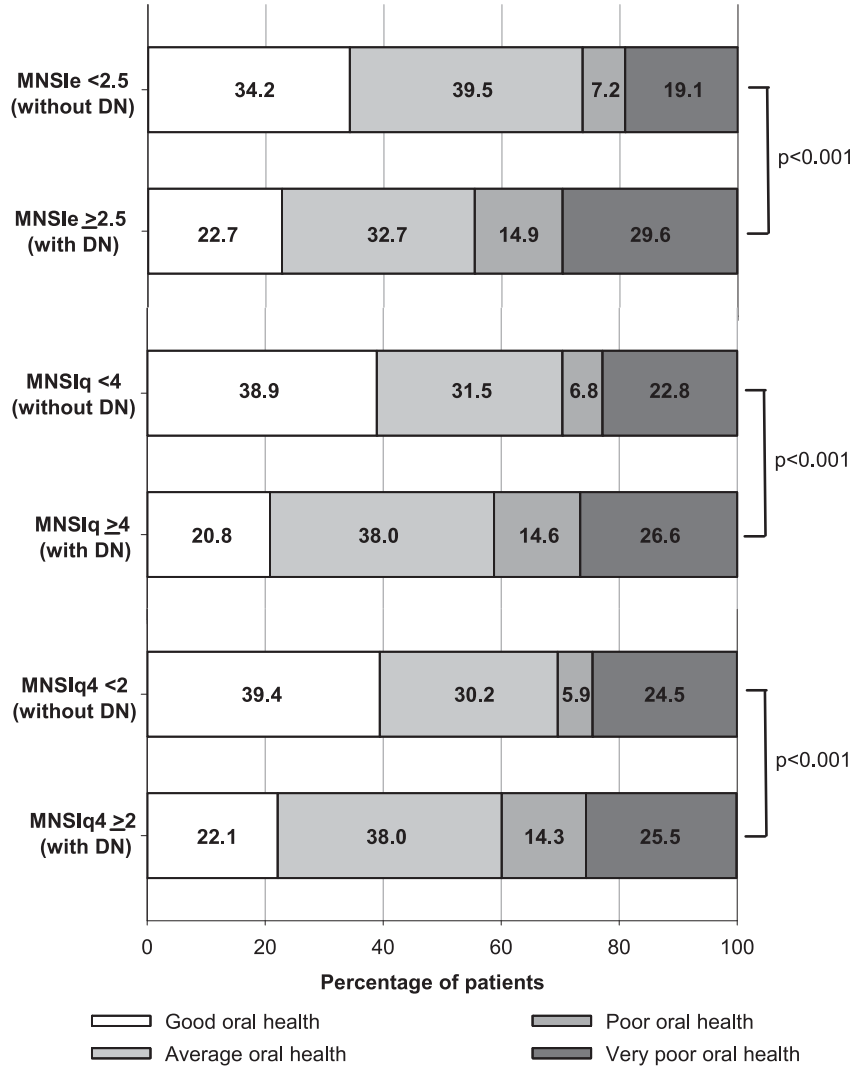

Figure 1—Distribution of MNSI scores according to self-reported oral health status. *P* value obtained with χ^2 test for trend. Percentages are calculated from the total number of patients with an MNSIe/MNSIq score above/below the cutoff, as specified.

3.91) and 5.03 (4.70–5.37) for very poor OH. Patients with poor and very poor OH had significantly higher mean MNSIe and MNSIq scores than patients with good OH ($P < 0.001$ for both scores). There was no difference between MNSIe scores of patients with poor and very poor OH ($P = 0.875$). MNSIq scores of patients with very poor and average OH were similar ($P = 0.964$), suggesting that complete loss of teeth may eliminate the chronic inflammation accompanying PD and delay the onset and progression of DN (1,2). The association of clinical and symptomatic DN and poorer OH outcomes remained significant after controlling for age, sex, and diabetes duration (odds ratio [95% CI] for MNSIe ≥2.5: 1.23 [1.10–1.36], $P < 0.001$; for MNSIq ≥4: 1.20 [1.08–1.34], $P = 0.001$; and for MNSIq4 ≥2: 1.14 [1.02–1.27], $P = 0.021$).

This study shows that symptoms of poor OH are frequent in Romanian patients with diabetes and that patients with DN have poorer OH. Its main limitations are the lack of a formal oral examination to confirm PD in patients with OH symptoms and of time-dependent data on glucose control. The large sample, diagnosis of DN using a highly validated instrument, and the potentially high impact of our findings on the clinical care of patients with diabetes represent notable strengths. Other large studies such as this are needed to validate the association between OH status, DN, and other complications. In summary, diabetologists need to be aware of and implement measures to screen and improve OH in their patients, especially those with concurrent DN.

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