

# Tooth loss in diabetic patients with and without end-stage renal disease and dialysis

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## SUMMARY

**Aim:** To compare tooth loss (TL) in ESRD (ESRD DM) and non-ESRD (DM) type 2 diabetic patients.

**Methods:** Teeth loss was quantified, and dentition classified as: Non-Compromised (NCD) with  $\geq 25$  teeth, partially compromised (PCD) with 9 to 24, and compromised (CD) with 0 to 8 teeth. Results: ESRD DM and DM:  $n = 103$  and  $130$ , mean age  $57.9$  and  $58.5$  yr ( $p = 0.716$ ), and at diabetes diagnosis  $38.5$  and  $47.8$  yr ( $p < 0.001$ ). Edentulous  $23.5\%$  and  $13.8\%$  ( $p = 0.057$ ), NCD  $24.5\%$  and  $35.4\%$  ( $p = 0.074$ ). TL was strongly associated mainly to periodontal disease ( $p < 0.001$ ). For ESRD DM, a low serum albumin ( $< 3.5$  g/dl) was more prevalent in peritoneal dialysis cases ( $p = 0.0014$ ), women ( $p = 0.0100$ ), people reporting unpleasant taste (UT) ( $p = 0.0174$ ), and those with a CD ( $p = 0.0242$ ).

**Conclusions:** There was a clear trend for more severe TL in ESRD DM cases, but no statistical difference was found. The association between low serum albumin, UT and CD imply a need for treatment of these conditions as a part of nutritional intervention in ESRD DM cases.

**Key words:** Diabetes mellitus, end stage renal disease, tooth loss, edentulia, periodontal disease, serum albumin.

## RESUMEN

**Objetivos:** Comparar la pérdida de dientes (PD) en diabéticos tipo 2 con (DM IRC) y sin (DM) insuficiencia renal crónica.

**Métodos:** Se cuantificó la pérdida de dientes (PD) y se clasificó en: dentadura no comprometida (DNC)  $\geq 25$  dientes, parcialmente comprometida (DPC) 9 a 24, comprometida (DC) 0 a 8.

**Resultados:** DM IRC y DM:  $n = 103$  y  $130$ , edad promedio  $57,9$  y  $58,5$  años ( $p = 0,716$ ), y al diagnóstico de diabetes  $38,5$  y  $47,8$  años ( $p < 0,001$ ), edéntulos  $23,5\%$  y  $13,8\%$  ( $p = 0,057$ ), DNC  $24,5\%$  y  $35,4\%$  ( $p = 0,074$ ). La PD se asoció fundamentalmente a EP ( $p < 0,001$ ). En DM IRC, albúmina baja ( $< 3,5$  g/dl) fue más frecuente en diálisis peritoneal ( $p = 0,0014$ ), mujeres ( $p = 0,0100$ ), personas que sufrían mal sabor de boca (MSB) ( $p = 0,0174$ ) y DC ( $p = 0,0242$ ).

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**Conclusiones:** Existe una tendencia clara, pero no se confirma mayor PD en DM IRC vs DM. La asociación de albúmina baja con MSB y DC sugiere manejo de estas condiciones como parte del manejo nutricional del paciente diabético con IRC.

**Palabras clave:** Diabetes mellitus, insuficiencia renal crónica, pérdida de dientes, edentulia, enfermedad periodontal, albúmina sérica.

## INTRODUCTION

In the oral cavity, diabetes predisposes to severe periodontal disease (PD).<sup>1</sup> Some known risk factors include chronic hyperglycemia, microvascular disease, and cell immunity changes.<sup>1</sup> Patients with long-standing diabetes have on average a high tooth loss (TL) rate.<sup>2</sup> Patients with ESRD experience changes in oral mucosa, periodontium, teeth, and maxillary bones,<sup>3,4</sup> and diabetics with ESRD may suffer a greater TL because of the combined damage resulting from diabetes and ESRD. While PD and TL are known to be frequent oral complications of the diabetic condition, no comparative data are available about their prevalence and severity in diabetic patients with and without ESRD. On the other hand, diabetics with ESRD frequently suffer severe malnutrition,<sup>5</sup> and their edentulous state could be considered to have a potential role in the multifactorial origin of such malnutrition. The aim of this study was therefore to compare the severity of tooth loss, and to investigate its risk factors and some possible consequences, in patients with type 2 diabetes with ESRD on chronic dialysis and with no renal insufficiency.

## PATIENTS AND METHODS

This study was conducted at the nephrology, internal medicine, and family medicine outpatient clinics and the peritoneal dialysis and hemodialysis units of two IMSS hospitals in San Luis Potosí. TL, PD, and oral symptoms and signs related to ESRD were studied in type 2 diabetics with ESRD on peritoneal dialysis or hemodialysis (ESRD DM) and type 2 diabetics with serum creatinine levels under  $2.0$  mg/dL (DM). Demographic, clinical, and laboratory data were collected. For tooth loss evaluation purposes, functional teeth (FT) were de-

**Table I. Multiple logistic regression for low serum albumin levels (< 3.5 mg/dL) in the ESRD DM group**

Variable		OR	95% CI	Coefficient	SE	Z	P	
Unpleasant taste	(yes/no)	8.63	1.46	51.06	2.156	0.907	2.378	0.0174
Uremic breath	(yes/no)	2.29	0.39	13.38	0.83	0.901	0.918	0.3586
Compromised dentition	(yes/no)	6.66	1.28	34.70	1.897	0.842	2.253	0.0242
Type of dialysis	(PD/HD)	14.54	2.82	75.03	2.677	0.837	3.197	0.0014
Sex	(F/M)	7.80	1.64	37.22	2.054	0.797	2.578	0.0100
Dry mouth	(yes/no)	0.29	0.05	1.64	-1.25	0.889	-1.403	0.1603
CONSTANT		*	*	*	-7.8978	2.1254	-3.7160	0.0002

OR: Odds ratio; 95% CI: 95% confidence interval.  
Compromised dentition:  $\leq$  8 teeth.

defined as those exerting their masticatory function. Patients were considered to have a non-compromised dentition (NCD) when they had  $\geq$  25 teeth, a partially compromised dentition when they had from 9 to 24 teeth, and a compromised dentition (CD) when  $\leq$  8 teeth remained. In patients with functional teeth, PD was assessed using the Community Periodontal Index of Treatment Needs,<sup>6</sup> scored as follows: 0 = healthy periodontium; 1 = gingival inflammation; 2 = gingival calculus; 3 = 4.5 mm pocket; 4  $\geq$  6 mm pocket; and X = excluded sextant (without FT). Oral hygiene was rated using the Simplified Oral Hygiene Index (OHI-S) A descriptive statistical analysis was made of demographic variables. Continuous variables were compared using a Student's *t* test, and proportion using a Chi-square test. Associations were analyzed by multiple linear regression and logistic regression as applicable using Epi Info version 3.4.3, including in a first analysis variables potentially associated to the dependent variables tooth loss, periodontal disease, and hypoalbuminemia, and in a second analysis only those variables showing a value of *p* less than 0.50 in the first analysis. A value of *p* < 0.005 was considered statistically significant.

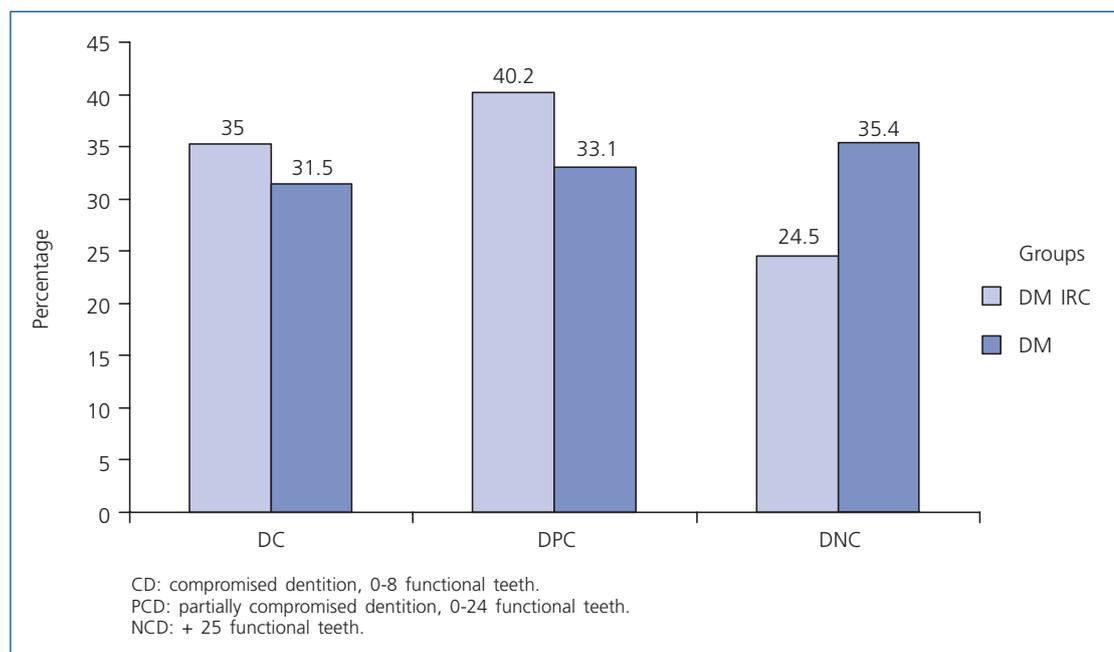
## RESULTS

Values refer to the ESRD DM and DM groups, in that order, consisting of 103 and 130 patients respectively. No differences were found in age ( $57.9 \pm 11.4$  vs  $58.5 \pm 11.5$  years, *p* = 0.716), sex distribution, or schooling. Age at diagnosis of type 2 diabetes was  $38.5 \pm 14.0$  vs  $47.8 \pm 12.1$  years (*p* < 0.001). In ESRD DM patients, the median known duration of diabetes before dialysis was 17 years (1-39), and the median time on dialysis 7 months (1-88). Fourteen (13.6%) ESRD DM and 29 (22.3%) DM patients reported current or prior smoking (*p* = 0.088); 45.6% and 26.9% (*p* = 0.003) reported unpleasant taste, and 43.7% and 35.4% (*p* = 0.197) had dry mouth. The number of teeth lost was  $17.2 \pm 11.5$  vs  $15.1 \pm 11.2$  (*p* = 0.168). CP or PCD was found in 75.5% and 64.6% (*p* = 0.074), 23.5% and 13.8% of whom were totally edentulous (*p* = 0.057) (fig. 1). In multiple linear regression, the number of teeth preserved was associated in ESRD DM patients to PD alone (*p* = 0.00004), and in DM patients to PD (*p* = 0.008), age (*p* = 0.010) and, marginally, to years since

onset of diabetes (*p* = 0.058). PD was in turn associated in multiple logistic regression to poor oral hygiene (*p* = 0.0006), dry mouth (*p* = 0.011), and a shorter diabetes duration before ESRD and dialysis (*p* = 0.035) in ESRD DM patients, and to poor oral hygiene alone in DM patients (*p* < 0.00001). In 81.1% of ESRD DM patients on peritoneal dialysis and 37.0% of those on HD, low serum albumin levels were found < 3.5 g/dl (*p* = 0.0003), with mean values of  $2.9 \pm 0.8$  in PD vs.  $3.5 \pm 0.7$  in HD (*p* = 0.002). Table I shows multiple logistic regression. Low albumin levels were associated to peritoneal dialysis, female sex, reporting of unpleasant taste, and compromised dentition ( $\leq$  8 teeth remaining), but not to age, years of diabetes, months on dialysis, body mass index, or other oral mucosa symptoms or changes.

## DISCUSSION

Tooth loss is associated to various risk factors.<sup>7,8</sup> Age is a significant factor. The reported prevalence of edentulism in a group of Mexican-American adults was 4.3%.<sup>9</sup> Mean edentulism rates of 16.4% have been reported in patients on hemodialysis,<sup>10</sup> with figures of 20.9% and 3.5% for diabetic and non-diabetic patients respectively.<sup>11</sup> Association between TL and diabetes has mainly been explained by a poor chronic glycemic control<sup>2,8,9</sup> and severe periodontal disease.<sup>12,7</sup> This study found 23.5% and 13.8% edentulous patients (*p* = 0.057), and patients with CD and PCD represented 75.5% and 64.6% (*p* = 0.074). PD was by far the main risk factor for tooth loss in both groups. Age and, marginally, years since diabetes onset were also risk factors in the DM group. TL reduces masticatory efficiency and food enjoyment,<sup>12,13</sup> promotes the intake of soft food, often rich in cholesterol and saturated fat, and hinders consumption of fiber and vegetables, and may cause impaired nutrition<sup>14,15</sup> and an increased cardiovascular risk.<sup>15</sup> Patients with ESRD and chronic dialysis, particularly diabetics, frequently experience severe malnutrition due to disease effects on the one hand<sup>5,16</sup> and to the effects of treatment on the other hand.<sup>16,17</sup> It is therefore relevant the finding in the ESRD DM group of an association between compromised dentition and low serum albumin, a known risk factor for increased morbidity and mortality in patients on chronic dialysis.<sup>17</sup> TL exceeding a certain level compromises the mas-



**Figure 1.** Comparison of tooth status in diabetic patients with (ESRD DM) or without (DM) ESRD and chronic dialysis.

tatory function. This has been called “functional edentulism”,<sup>8,14</sup> and edentulous patients are considered to be orally disabled, and may only achieve partial rehabilitation despite prosthetic treatment.<sup>14</sup> When oral disability is added to other frequent causes of disability in diabetes such as ESRD, ocular, cardiovascular, and neurological disease, the clinical picture—and probably prognosis—worsens, often resulting in a therapeutic nihilism status known as renalism,<sup>18</sup> which is frequent in coronary artery disease in renal diabetics,<sup>19</sup> but also possibly common in oral medicine, as suggested by the low frequency of denture use among total or functional edentulous patients in both our study groups, but more marked in ESRD DM patients.

While a clear trend exists to a greater tooth loss in the ESRD DM group, our data showed no statistical difference in its frequency and severity—nor in those of PD—between both study groups, and agree with previous reports that ESRD does not contribute to PD severity.<sup>20</sup> If confirmed by other studies, the explanation for the marginal increase in CD and PCD frequency in the ESRD DM group should be searched for in other factors not identified in our data. Age differences at diabetes diagnosis could be part of the explanation, probably with a longer mean time since PD onset (edentulous patients, who did not participate in PD comparison, probably lost their teeth for this same reason). A clear need exists of preventive and therapeutic oral care, including oral hygiene, with reinforcement of instructions on brushing techniques at the time diabetes is diagnosed, periodontal disease care, and TL management, as part of the treatment requirements of diabetic patients with or without chronic complications, but particularly in renal diabetic patients, whose nutritional status is an essential factor in their chances of survival. The high prevalence of poor oral hygiene in both patient groups, which agrees with other reports in patients on dialysis,<sup>7,10,11</sup> represents an adequate starting point of the oral component of ma-

nagement, but it would also be probably useful to explore the effect of sugar-free chewing gum or alcohol-free disinfecting mouthwashes that would promote removal of the bacterial dental plaque or oral biofilm accumulated on the teeth and tongue, which is in part one of the factors associated to an unpleasant oral taste. This unpleasant taste possibly acts upon nutritional evolution by preventing diabetic patients with ESRD on chronic dialysis to feel the taste of food.

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