

Oral health status in patients with moderate-severe and terminal renal failure

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ABSTRACT

Aims. To evaluate the oral health status of patients with moderate-severe chronic renal failure (CRF) and with terminal renal failure (TRF).

Design. The study group was formed of 50 patients: 22 (44%) with moderate-severe CRF and 28 (56%) with TRF included in a haemodialysis programme. The controls (n=64) presented similar characteristics with regard to sex, age, weight and educational level. A single dentist performed an intraoral examination on all the subjects, gathering information on: number of decayed, missing or filled teeth; supragingival plaque accumulation; calculus deposits; periodontal pockets in the Ramfjord teeth; and loss of insertion.

Results. No significant differences were detected in the values of the DMF index between the two groups. The mean number of decayed teeth was lower in the patients than in the controls, showing a tendency to statistical significance (p=0.052). The mean number of missing teeth was higher in the patients than in the controls (p=0.002). Twelve patients and seven controls were completely edentate. The mean number of filled teeth was significantly lower in the patients than the controls (p<0.001). Supragingival plaque accumulation and the loss of insertion were significantly greater in the patients than in the controls (p=0.006 and p<0.001, respectively). No significant differences were found with respect to the calculus deposits or to the presence of periodontal pockets in the two groups.

The value of the DMF index, the mean number of teeth with caries and the number of filled teeth were significantly higher in the patients with moderate-severe CRF than in the patients with TRF (p=0.004, p=0.030 and p=0.006, respectively).

Conclusions. Patients with CRF have a lower prevalence of caries, more supragingival plaque, more teeth with a loss of insertion and more missing teeth than the healthy controls. The prevalence of caries is affected by the severity of the renal failure and/or by haemodialysis treatment.

Key words: Renal failure, haemodialysis, oral health, DMF index, oral hygiene index, calculus deposits, depth of the periodontal pockets, periodontal disease index.

RESUMEN

Objetivos. Evaluar el estado de salud oral de pacientes con insuficiencia renal crónica moderada/severa (IRC-MD) y con fallo renal terminal (FRT).

Diseño. El grupo de estudio lo constituyeron 50 pacientes: 22 (44%) con IRC-MD y 28 (56%) con FRT incluidos en un

programa de hemodiálisis. Los controles (n= 64) tenían características similares en relación al sexo, edad, peso y nivel educacional. Se realizó una exploración intraoral a todos los participantes recogiendo información acerca de: número de dientes cariados, ausentes y obturados; acúmulo de placa supragingival; acúmulo de cálculo; profundidad de bolsas periodontales en los dientes de Ramfjord; y pérdida de inserción.

Resultados. No se detectaron diferencias significativas en los valores del índice CAO entre pacientes y controles. El número medio de dientes cariados fue inferior en los pacientes que en los controles ($p= 0,052$). En los pacientes, el número medio de dientes ausentes fue mayor que en los controles ($p= 0,002$). Había 12 pacientes y 7 controles totalmente edéntulos. El número medio de dientes obturados fue significativamente inferior en los pacientes que en los controles ($p < 0,001$). El acúmulo de placa supragingival y la pérdida de inserción fue significativamente mayor en los pacientes que en los controles ($p= 0,006$ y $p < 0,001$, respectivamente). No se encontraron diferencias significativas en relación al acúmulo de cálculo ni a la presencia de bolsas periodontales entre ambos grupos.

El valor del índice CAO, el número medio de dientes cariados y el de obturados fue significativamente superior en los pacientes IRC-MD que en los pacientes FRT ($p= 0,004$, $p= 0,030$ y $p= 0,006$, respectivamente).

Conclusión. Los pacientes con IRC tienen menor prevalencia de caries, más placa supragingival, más dientes con pérdida de inserción y más ausencias dentarias, que los controles sanos. La prevalencia de caries está condicionada por la severidad de la insuficiencia y/o por el tratamiento de hemodiálisis.

Palabras clave: *Insuficiencia renal, fallo renal terminal, hemodiálisis, salud oral, índice CAO, índice de higiene oral, índice de cálculo, profundidad de bolsas, índice de enfermedad periodontal.*

INTRODUCTION

Renal failure is a process that expresses a loss of functional capacity of the nephrons, independently of its aetiology. It is classified into acute, subacute and chronic (CRF) based on its form of onset and, above all, on the possibilities for recovery of the structural lesion (1). Although acute renal failure is reversible in the majority of cases, CRF presents a progressive course towards terminal renal failure (TRF), even if the cause of the initial nephropathy disappears (2). When the glomerular filtration rate (GFR) is < 15 ml/min (TRF), it is necessary to start renal replacement therapy to avoid the serious complications which can lead to the death of the patient. There are three forms of replacement therapy: haemodialysis, peritoneal dialysis and renal transplant. In Spain, haemodialysis (HD) is the most widely used technique.

Dialysis leads to systemic alterations, oral complications and variations in the flow and composition of the saliva (3-5); if we add to this the lack of compliance with the habits of oral hygiene shown by many of these patients (6), this population should present a significant prevalence of caries, periodontitis and oral lesions. However, there are a few articles in the literature in which the oral health status and the need for dental treatment have been specifically analysed in patients with CRF, and their results are contradictory (7). Furthermore, we have not found any study published to date in which the oral health status has been compared between patients with different degrees of CRF.

The degree of renal failure could alterate the balance of the stomatognathic system, thus conditioning the prevalence of common oral diseases such as caries and periodontal disease. In consequence, the objective of this study has been to evaluate the oral health status of patients with moderate-severe CRF and with TRF.

PATIENTS AND METHODS

This study has been designed as an observational, case-control study and was performed in the Francisco Gentil Portuguese Institute of Oncology (Oporto, Portugal). The patients regularly attended the Nephrology Department, the controls were blood donors registered in the Immuno-Haemotherapy Department, and the analysis of the biochemical parameters was performed in the Department of Biochemistry and Clinical Analysis. This project was approved by the Hospital Ethics Committee of the Francisco Gentil Portuguese Institute of Oncology (Oporto, Portugal). Informed consent to participate in the trial was obtained from all the patients.

The inclusion criteria applied to select the participants were: age greater than 18 years; a GFR < 60 ml/min for patients and GFR > 90 ml/min for controls. The following exclusion criteria were applied: suffering any systemic disease that could affect the GFR and/or the oral health status; receiving any type of medication that could affect the oral health status; being a smoker and/or habitual drinker.

The study group was formed of 50 patients with moderate-severe CRF or with TRF: 27 women and 23 men; mean age = 64 ± 11 years; mean weight = 74.78 ± 4.60 kg; 42% had primary education, 37% secondary education and 21% higher education. The 64 controls presented similar characteristics with regard to sex (34 women and 30 men), age (mean age = 60 ± 11 years), weight (mean weight = 75.50 ± 4.94 kg) and educational level (38% had primary education, 35% secondary education and 27% higher education).

A single dentist performed an intraoral examination of each patient, collecting data about: number of teeth with decayed, missing or filled teeth (DMF index); supragingival plaque accumulation (the simplified Greene and Vermillion oral hygiene index) (8); calculus deposits (the Ramfjord calculus index) (9); depth of the periodontal pockets of the Ramfjord

teeth; depth of the loss of insertion (the modified Ramfjord periodontal disease index) (10).

Blood samples were taken from both the patients and the controls to determine the creatinine concentration, the creatinine clearance (calculated using the Cockcroft-Gault formula (11), and the urea concentration.

The results obtained in the present study were analysed using the SPSS version 12.0 statistical package for Windows (SPSS Inc. Chicago, USA). Fisher's exact test or the FxC Chi squared test were used to study the qualitative variables. Statistical significance was taken as a value of $p < 0.05$. Odds ratio with 95% confidence interval was also calculated.

RESULTS

Of the 50 patients in the study group, 22 (44%) satisfied the criteria for moderate-severe CRF and 28 (56%) for TRF. The most frequent causes of CRF were: pyelonephritis, segmental focal glomerulosclerosis, tuberculosis, myelomatosis and hypertension.

All the patients with TRF were on haemodialysis treatment whereas the patients with moderate-severe CRF were on pharmacological-dietary treatment.

The following variables are presented in Table 1 both for the patients and for the controls: the DMF index, the number decayed, missing or filled teeth, the accumulation of supragingival plaque and of calculus, the periodontal pockets and the loss of insertion.

No significant differences were detected in the values of the DMF index between the two groups (patients = 17.14 ± 7.79 and controls = 15.23 ± 7.07). The mean number of decayed teeth was lower in the patients than in the controls (1.68 ± 1.57 and 2.58 ± 2.48 , respectively), showing a tendency to statistical significance ($p = 0.052$). The mean number of missing teeth was 14.08 ± 9.12 in the patients and 9.09 ± 7.95 in the controls; this difference was statistically significant ($p = 0.002$). There were twelve patients and seven controls who were edentate. The mean number of filled teeth was significantly lower in the patients than in the controls (2.34 ± 2.75 versus 4.32 ± 2.49 ; $p < 0.001$).

Table 1. Number of decayed, missing or filled teeth, supragingival plaque and calculus accumulation, periodontal pockets and loss of insertion in patients with CRF/TRF (n=50) and in controls (n=64).

	CRF/ TRF PATIENTS ($\mu \pm \delta$)	CONTROLS ($\mu \pm \delta$)	STATISTICAL SIGNIFICANCE
DMF INDEX	17.14 \pm 7.79	15.23 \pm 7.07	p=0.175
MISSING	14.08 \pm 9.12	9.09 \pm 7.95	p=0.002
DECAYED	1.68 \pm 1.57	2.58 \pm 2.48	p=0.052
FILLED	2.34 \pm 2.75	4.32 \pm 2.49	p < 0.001
	CRF PATIENTS n (%)	CONTROLS n (%)	STATISTICAL SIGNIFICANCE
SUPRAGINGIVAL PLAQUE			
Grades 0-1	10 (26.3)	32 (56.1)	p=0.006
Grades 2-3	28 (73.7)	25 (43.9)	
CALCULUS			
Grades 0-1	19 (50.0)	24 (42.1)	p=0.530
Grades 2-3	19 (50.0)	33 (57.9)	
PERIODONTAL POCKETS			
< 4 mm	33 (86.8)	42 (73.7)	p=0.198
\geq 4 mm	5 (13.2)	15 (26.3)	
LOSS OF INSERTION*			
Grade 0	1 (3.8)	30 (52.6)	p < 0.001
Grades 1-3**	25 (96.2)	27 (47.4)	

CRF=moderate-severe chronic renal failure; TRF=terminal renal failure

*In some patients it was not possible to visualise the cement-enamel junction.

**A loss of insertion of grade 1-2 was diagnosed in 8 patients (30.8%) with CRF and of grade 3 in the remaining 17 patients (65.4%). A loss of insertion of grade 1-2 was diagnosed in 15 controls (26.3%) and of grade 3 in the remaining 12 (21.1%).

Table 2. Number of decayed, missing or filled teeth, supragingival plaque and calculus accumulation, periodontal pockets and loss of insertion in patients with CRF (n=22) and with TRF (n=28).

	CRF PATIENTS ($\mu \pm \delta$)	TRF PATIENTS ($\mu \pm \delta$)	STATISTICAL SIGNIFICANCE
DMF INDEX	20.64 \pm 6.19	14.39 \pm 7.91	p=0.004
MISSING	16.59 \pm 9.18	12.11 \pm 8.72	p=0.084
DECAYED	2.36 \pm 1.27	1.29 \pm 1.62	p=0.030
FILLED	4 \pm 3.21	1.38 \pm 1.92	p=0.006
	CRF PATIENTS n (%)	TRF PATIENTS n (%)	STATISTICAL SIGNIFICANCE
SUPRAGINGIVAL PLAQUE			
Grades 0-1	3 (21.4)	7 (29.2)	p=0.715
Grades 2-3	11 (78.6%)	17 (70.8)	
CALCULUS			
Grades 0-1	6 (42.9)	13 (54.2)	p=0.737
Grades 2-3	8 (57.1)	11 (45.8)	
PERIODONTAL POCKETS			
< 4 mm	13 (92.9)	20 (83.3)	p=0.633
\geq 4 mm	1 (7.1)	4 (16.7)	
LOSS OF INSERTION*			
Grade 0	1 (8.3)	0 (0.0)	p=0.493
Grades 1-3**	11 (91.7)	14 (100)	

CRF=chronic renal failure; NoHD = No haemodialysis; HD = Haemodialysis

*In some patients it was not possible to visualise the cement-enamel junction.

**A loss of insertion of grade 1-2 was diagnosed in 3 patients (25%) with CRF-NoHD and of grade 3 in the remaining 8 patients (66.7%). A loss of insertion of grade 1-2 was diagnosed in 5 patients (35.7%) with CRF-HD and of grade 3 in the remaining 9 patients (64.3%).

Levels of supragingival plaque of $\geq 2/3$ were detected in 73.7% of the patients whereas these levels were detected in only 43.9% of the patients.

Statistically significant differences were observed in the supragingival plaque deposits between the two groups (p=0.006). The percentage of subjects with a loss of insertion was significantly higher among the patients than among the controls (96.2% versus 47.4%; p<0.001). No significant differences were observed between the two groups with respect to the calculus deposits or the presence of periodontal pockets.

Table 2 presents the following variables for the patients with moderate-severe CRF and the patients with TRF: the DMF index, the number of decayed, missing or filled teeth, the accumulation of supragingival plaque and calculus, periodontal pockets and loss of insertion.

The value of the DMF index was significantly higher in the patients with CRF than in the patients with TRF (20.64 \pm 6.19 and 14.39 \pm 7.91, respectively; p=0.004). The mean number of decayed and filled teeth was higher in the patients with CRF (2.36 \pm 1.27 and 4 \pm 3.21, respectively) than in the patients with TRF (1.29 \pm 1.62 and 1.38 \pm 1.92, respectively); these differences were statistically significant (p=0.030 and p=0.006, respectively).

With regard to the accumulation of supragingival plaque and calculus, the presence of periodontal pockets and the loss of insertion, similar frequencies were observed in the patients with CRF and in those with TRF.

DISCUSSION

In agreement with other authors (12-14), we did not observe significant differences between the DMF index of the patients and controls in the present study. However, this index has serious limitations that would recommend restricting its application to those age groups in which the edentate state is due exclusively to caries. In consequence, in the present study, a number of evaluations were performed independently of the number of decayed, missing or filled teeth in order to complete the information provided by the DMF index.

In 1986, Locsey et al (15) published the results of a prospective study of patients with CRF on haemodialysis, reporting that "the majority of patients had lost many of their teeth prematurely". Klassen and Krasko (16) found 53 totally edentate subjects in a group of 147 patients with TRF on peritoneal dialysis or haemodialysis. Al-Wahadni and Al Omari (17) found nine totally edentate subjects in

a group of 56 individuals on dialysis, despite the mean age being only 42 years. Recently, in a series published by Bots et al (14), the frequency of the totally edentate state in a group of patients included in a haemodialysis programme was of 23%.

In the present series, the percentage of totally edentate subjects and the mean number of missing teeth was higher among the patients than among the controls, particularly in the moderate-severe CRF group. After excluding other factors potentially involved in tooth loss, such as age (18) or low socio-economic status (19), it appears that the increase in bone remodelling, probably as an expression of a hyper-production of parathormone, could play a primary role in the aetiopathogenesis of the edentate state associated with CRF (15). In the present series, we detected a statistically significant relationship between the loss of insertion and the number of missing teeth ($p=0.005$). However, some authors have not observed radiological differences in the loss of alveolar bone between the patients with TRF on haemodialysis and healthy controls (20), and experimental studies in animals have shown that the bone density evaluated by optical densitometry is not altered in nephrectomised rats (21).

In the present study, the prevalence of active caries and of fillings was lower in the patients than the controls, particularly in the patients with TRF. Very few authors have evaluated the frequency of caries in adults with CRF (14,17,22). Chuang et al (22) reported that patients with diabetic nephropathy had more caries than those with CRF of non-diabetic aetiology. In a more recently published series by Bots et al (14), the number of decayed teeth in the patients with TRF on dialysis was similar to that of the healthy controls. With respect to the prevalence of fillings, Bayraktar et al (13) found a lower index of restorations in a group of patients with TRF on haemodialysis than in a control group, although the difference did not reach statistical significance. Recently, Bots et al (14) found no differences in the number of fillings between a group of patients with CRF on dialysis and a control group, although this series had certain limitations, as they excluded patients under 25 years of age or over 52 years of age and those with serious difficulties for travelling.

In the present study, dental plaque accumulation was greater in the patients with CRF, both in those with moderate-severe CRF and in those with TRF, than in the control group. It has been suggested that in adults on haemodialysis, the plaque index is also higher than in the general population (12,23). However, in more recent series, similar plaque indices have been found in patients on dialysis programmes and in healthy controls (14,20,24). Plaque accumulation is a direct expression of oral hygiene habits. It has been suggested that in many patients with CRF, the habits of oral care at home are inadequate and the level of hygiene unacceptable (25,26). The psychological repercussions of a serious, chronic illness such as renal failure could lead to non-compliance with the habits of oral hygiene. However, Galili et al (6) demonstrated in a group of patients with

CRF (HD and transplanted patients), that they had a lower dental awareness, less preoccupation with their oral health status, a similar capacity for facing difficulties, and a more stable self-esteem than the controls. In summary, plaque accumulation appears to be dependent principally on factors of socio-cultural characteristics, meaning that, in agreement with Durán and Erdemir (18), education in oral hygiene should become a primary objective in this group.

In the present series, calculus deposition was similar in the patients with CRF, both those with moderate-severe CRF and those with TRF, and in the healthy controls. In 1980, Epstein et al reported that the thickness of the dental calculus deposits in patients with CRF was greater than in patients with no systemic diseases (3). Subsequently, some authors reported significant calculus deposits in patients on haemodialysis (15,25). However, we have only found three publications in which it has been confirmed that the calculus index of patients with CRF was significantly greater than that of a healthy controls (12,14,27). These differences with respect to our results could be explained on the basis of the calculus index used; Bots et al (14), for example, found significant differences in the absolute number of teeth with calculus among patients with CRF on dialysis and controls, but not in the percentage of teeth with supra- or subgingival calculus.

Although some authors have reported that the prevalence of periodontal disease is high among patients on haemodialysis, these reports are usually poorly substantiated, as the studies often lacked a control group (15,25) or include other diseases such as severe gingivitis under the title of periodontal disease (25). Our results agree with the majority of previous publications (14,18,20,24), in which the periodontal disease in patients with CRF is similar to that of the general population in terms of the prevalence and depth of pockets.

In the literature reviewed, we found only three studies in which explicit reference is made to the loss of insertion. Gavaldá et al (12) and Frankenthal et al (20) suggested that the loss of insertion in patients included in haemodialysis programmes was similar to that of the controls. We found a greater loss of insertion in the patients with CRF although, in some cases, it was not possible to visualise the cement-enamel junction, which could have affected our result. Klassen and Krasco (16) studied a series of 94 patients on dialysis and found gingival recession in ≥ 5 tooth surfaces in 49% of cases, although they also noted the technical difficulty. Although the aetiopathogenesis of the loss of insertion has not been studied in patients with CRF, by grouping all the members of the present series (patients with CRF and controls) we detected a statistically significant relationship between plaque accumulation and the loss of insertion (OR=7.82; 95% CI=2.839-21.453).

In summary, patients with CRF have a lower prevalence of caries, more supragingival plaque, more teeth with loss of insertion and more missing teeth than healthy controls. The prevalence of caries was lower in the patients with TRF than in the patients with CRF; this means that the severity of

the renal failure and/or haemodialysis treatment represent a protective factor against caries, but their action mechanism remains unknown.

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