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Oral Heath Status in Moroccan Hemodialysis Patients

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Abstract: End-stage chronic kidney disease (CKD) and its treatment by hemodialysis represent a public health issue especially in Morocco. This study aimed to assess the impact of chronic renal failure on oral health in patients undergoing renal dialysis. A cross-sectional study was conducted among patients undergoing dialysis. The variables recorded were DMFT index and pH salivary. The correlation between oral health and the duration of dialysis was assessed. A total of 46 adult hemodialysis was evaluated, among them 52.2% were males, the mean age was 58.72 ± 12.4 years. All the patients in the sample underwent three dialysis sessions per week. Half of the patients brushed their teeth once a day. The average DMF-T index was 15.41 ± 6.04. Xerostomia was noted in 84.8% of the sample. This health situation analysis showed that dental care of the dialysis patients was not favorable, highlighting a great need for dental treatment. CKD cases should be made aware of the oral problems and their potential effect on overall health. A multidisciplinary approach with the involvement of different specialties is recommended.

Keywords: chronic kidney disease; hemodialysis; DMFT index; salivary pH

1. Introduction

Chronic kidney Disease (CKD) is a slow, progressive and irreversible loss of nephron function, leading to End-Stage Renal Disease (ESRD), the most severe form of CKD.

CKD is defined as kidney damage or a glomerular rate (GFR) of less than 6OmL/min/1.73m^2 for a duration of 3 months or more, regardless of the underlying cause [1].

While CKD primarily affects adults, it can impact individuals of all age groups. The disease is caused by various factors that gradually damage the functional nephron mass of the kidney, including diabetes, hypertension, glomerulonephritis, pyelonephritis, and others [2].

It is recommended to initiate renal replacement therapy after Stage 5 CKD (GFR < 15 mL/min/1.73 m^2) [3]. Renal replacement therapy includes hemodialysis (HD), peritoneal dialysis, and kidney transplantation, with HD being the most widely used intervention. HD plays a critical role in the survival of over a million people worldwide who have end-stage renal disease (ESRD) with little or no kidney function. The main goal of HD is to restore the intracellular and extracellular environment to resemble that of normal kidney function. The standard recommended frequency for dialysis is three sessions per week [3].

In Morocco, end-stage chronic kidney disease and its treatment by hemodialysis represent a public health issue [4].

Oral health is an integral part of general health, with numerous changes observed in the oral cavity in patients suffering from chronic renal failure. Studies suggest that up to 90% patients with renal disease show oral symptoms [5].

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The most common oral finding in patients with renal failure, particularly those undergoing hemodialysis, is pallor of the oral mucosa due to anemia. Gingival overgrowth, caused by an overproduction of gum tissue by fibroblasts, can occur as a side effect of certain medications, such as nifedipine and cyclosporine, and may serve as a site for local carcinoma development. Alterations in calcium and phosphate metabolism can lead to enamel opacities, loss of lamina dura, tooth loosening, bone fractures, and bone tumors due to secondary hyperparathyroidism. Interestingly, renal failure is associated with a lower prevalence of dental caries, which may be related to changes in oral pH [5]. In the other hand, oral health among patients undergoing hemodialysis has been reported to be poor primarily due to their delicate state, neglect of oral hygiene, manifestations of systemic conditions, and immunosuppression [6,7].

Oral health status in hemodialysis patients has gained attention in recent years, with numerous studies highlighting the prevalence of oral diseases.

In Morocco, the specific oral health challenges faced by hemodialysis patients remain underexplored. Given the cultural and dietary differences, as well as the specific healthcare environment, the oral health status of Moroccan HD patients may differ from findings in other regions.

The purpose of this study is to assess the impact of chronic renal failure on oral health in patients undergoing renal dialysis and to evaluate and enhance the awareness of staff regarding the oral healthcare needs of patients in the hemodialysis unit.

2. Materials and Methods

This is a cross-sectional study conducted in April 2024 within the hemodialysis units of the nephrology and hemodialysis department located in Kenitra, Morocco. The study focuses on the analysis of the oral health status of hemodialysis patients, with a primary emphasis on assessing the DMFT index (Decay – Missing – Filled Teeth index) and salivary pH.

The study was approved by the Institutional Review Board of Faculty of Dental Medicine – International University of Rabat.

2.1. Study Population

The sample size was calculated using calculator.net, with a 95% confidence interval corresponding to a z-score of 1.96 and a margin of error of 5%. We anticipated that 30% of the patients would refuse to participate in the study, and 15% would have incomplete data. Based on these assumptions, we determined that 46 participants would need to be enrolled to achieve the desired 95% confidence interval.

All patients who participated in the study received detailed information about the objectives and procedures of the study.

The study flowchart is shown in Figure 1.

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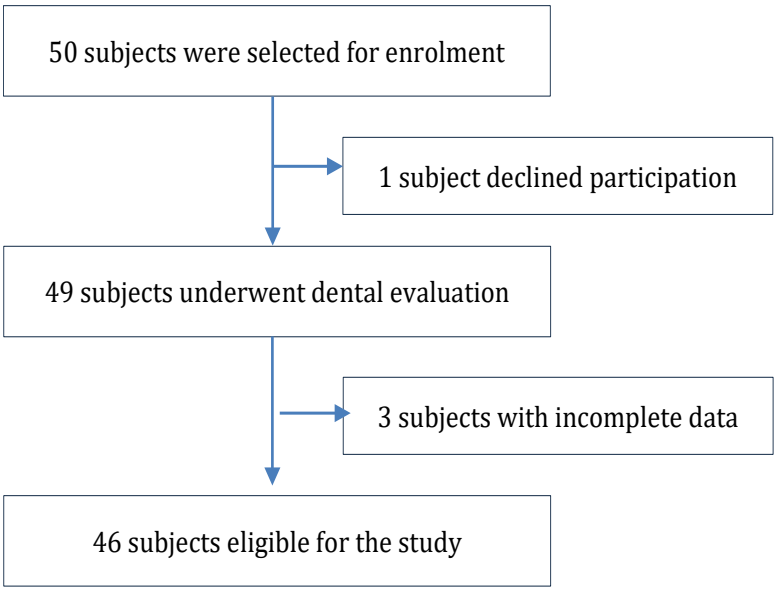

Figure 1. Study flow shart.

2.2. Anamnesis

For each included patient, a survey form was completed, in which the following information was recorded:

- Demographic data: age, gender
- Nephrological aspects:
  - The type of nephropathy
  - Associated diseases
  - The start date of dialysis
  - The number of session of dialysis per week
- Hygiene habits: This aspect includes the frequency of tooth brushing as well as the method used. It provides information about the patient's oral hygiene level.

2.3. Clinical Exam

Evaluation of oral hygiene, dental plaque accumulation and gingival health were performed with a periodontal probe, explorer No 6, and No 17, and a dental mirror. Dental plaque accumulation was assessed with Silness & Löe plaque index (PI), categorized as follows; (0) absence of microbial plaque; (1) thin film of microbial plaque along the free gingival margin; (2) moderate accumulation with plaque in the sulcus; (3) large amount of plaque in sulcus or pocket along the free gingiva margin. Following a standardized oral exam, a single examiner assessed all present teeth, except for the third molars, in order to determine the DMFT (decayed, missing and filled teeth) index, according to the criteria established by the World Health Organization (WHO).15 Each tooth was classified as Decayed: D (decayed teeth and filled teeth with caries or temporary filling material), Missing – subdivided in two categories; Extracted: E (teeth lost due to caries or other reasons) or Extraction indicated: Ei (extensive tooth decay that prevented tooth restoration procedures), or Filled: F (teeth that had been filled with permanent filling material and with no caries).

Salivary examination:

- Saliva quality: Viscous or watery

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- Xerostomia: Subjective assessment during the interview, using structured questions and measurement scales such as the Visual Analog Scale (VAS). Patients respond regarding the severity and impact of dry mouth on their daily activities.

Salivary pH: A pH is considered acidic if its value is below 7, basic if it is above 7, and neutral if it is equal to 7.

2.4. Statistical Analysis

All recorded data were initially entered into a Microsoft Excel 2019 database and subsequently transferred to the Statistical Package for the Social Sciences (SPSS) version 26.0 (SPSS Inc., Chicago, IL, USA). The data were coded and analyzed based on the severity of dental injuries. The Kolmogorov–Smirnov test was applied to assess the distribution of continuous variables. Variables exhibiting a normal distribution were presented as mean ± standard deviation (SD), while those with a non-normal distribution were reported as median and interquartile range (IQR).

To assess statistically significant differences between the two groups, the Student's t-test was used for comparing means (for normally distributed variables), while the Mann–Whitney U test was applied for comparing medians (for non-normally distributed variables). Categorical variables were analyzed using the chi-square test. The predictive value was determined through the analysis of the area under the receiver operating characteristic (ROC) curve (AUROC). Statistical significance was defined by a p-value < 0.05.

3. Results

A total of 46 adult HD patients were evaluated, 24 men (52.2%) and 22 women (47.8%) with a mean age of 58.72 ± 12.4.

Table 1. Patient's characteristics.

Parameters	Total (n=46)
Gender	
Female	22 (47.8)
Male	24 (52.2)
Age in years (mean ± SD)	(58.72 ± 12.4)
(minimum, maximum)	(25.84)
Basic disease	
Diabectic nephropathy	17 (37)
Interstitial nephritis	11 (24)
Vascular nephropathy	7 (15.21)
Glomerulonephritis	7 (15.21)
Polycystic Kidney	1 (2.17)
Other reasons	3 (6.52)

All the patients in the sample undergo three dialysis sessions per week, each lasting four hours. The duration of dialysis is presented in Table 2.

Table 2. Duration of dialysis (in months).

	Total (n=46)
Dialysis therapy lasting	
1-2	22 (47.82)
2-3	2 (4.34)
3-5	21 (45.65)
>5	1 (2.17)

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All the patients in the sample undergo three dialysis sessions per week, each lasting four hours.

Half of the patients (50%) brush their teeth once a day, and 6.5% do it three times a day (Table 3).

Twenty-seven patients had a plaque index of 3, representing 59% of the cases, compared to only 8% with a plaque index of 1

The average DMF-T was 15.41 ± 6.04. The proportion of D-T was 4.85±3.01, M-T was 9.17 ± 6.15, and the proportion of F-T was 1.39 ± 1.78.

Xerostomia is noted in 84.8% of the sample, or 39 patients.

Saliva is viscous in 63% of our sample,

The average pH of our sample is 6.29. It was found that 26.1% of the patients had a pH of 7, which is basic, 65.2% had a pH <7, indicating acidity, and only 8.7% of the population had an alkaline salivary pH of 8.

Table 3. Frequency of tooth brushing.

	Total (n=46)
Brushing teeth	
Never	10 (21.7)
1x/ day	23 (50)
2x/ day	10 (21.7)
≥3×/day	3 (6.5)

4. Discussion

The present study evaluates the oral health status by closely examining the DMFT index and salivary pH of patients with chronic kidney disease (CKD) undergoing hemodialysis treatment. Conducted in April 2024, the study focused on 46 patients from the nephrology and hemodialysis center.

Our findings showed that oral health behavior and oral health status in patients undergoing dialysis was not favorable. Half of the patients brushed their teeth twice once a day and 21% reported that they never brushed their teeth. This generally aligns with the findings of the study by Torabi et al., who reported that 25% of patients stated they never brushed their teeth [8]. This frequency was lower compared to the results of a Chinese study, which found that 77.78% of hemodialysis patients reported brushing their teeth at least twice a day, and 98.37% brushed more than once a day [9]. These findings highlight the significant need to encourage these patients to brush their teeth regularly.

The results showed that 47.82 % of patients had been undergoing dialysis for less than 2 years, those for 3-5years were 45.65%, and 2.17 more than 5 years. The study by Cengiz et al., in 2023 revealed the distribution of patients based on the duration of their hemodialysis treatment. The results showed that 15% of patients had been undergoing dialysis for less than a year, 30% for 1 to 3 years, 25% for 3 to 5 years, and 30% for more than 5 years [10]. In China, about half of the patients 41.50% have been under dialysis treatment for more than 5 years, and those for 3–5 years were 37.58% [9].

Regarding the number of dialysis sessions per week, all of our patients undergo three sessions per week, each lasting 4 hours. Francesco Locatelli et al., 2010, affirm that a session lasting 3 to 4 hours, every 2 or 3 days, is necessary [11]. Adhering to this guideline contributes significantly to improving the patients' quality of life.

In the sample study, 28.3% of patients had indeterminate nephropathy, 19.6% had diabetic nephropathy, 13% had hypertensive nephropathy, and only 4.3% had tubulo-interstitial nephropathy. In a similar study by Chaabouni et al., 2018 [12], diabetic nephropathy was diagnosed in 21.5% of cases. Interstitial nephropathy was reported in 15% of cases. Glomerular nephropathy was found in 7.9% of cases, and finally, the initial nephropathy remained indeterminate in 45.8% of cases. In China, The main reasons for terminal renal failure were glomerulonephritis (47.39% of the patients), hypertensive kidney lesion (17.97%), and diabetic nephropathy (14.05%) [9].

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The plaque index measured shows that oral hygiene is poor in these patients: 100% had poor plaque control (plaque index between 1 and 3), with 58.7% having a plaque index of 3.

During the study, we recorded 422 missing teeth, 224 decayed teeth, and 64 permanently filled teeth. The high number of missing teeth could be due to preventive concerns about focal infections that could arise from poorly adapted treatments on decayed teeth in these patients, or due to the patients' reluctance to receive dental treatments due to their general health condition and the chronic treatments they undergo. Additionally, factors such as xerostomia induced by hemodialysis combined with medication use, tend to worsen oral health and lead to extractions. The average number of decayed teeth in our population was 4.85, with a range from 0 to 16. Iran and Germany who reported the DMFT score as 22.1 ± 6.5 and 18.6 ± 9.9 respectively [6,12]. The average DMFT index was 15.41 ± 6.04. It was lower to the results from Germany and Iran who reported the DMFT score as 22.1 ± 6.5 and 18.6 ± 9.9 respectively [13,14].

The results found that the average pH of hemodialysis patients was 6.29, indicating an acidic pH. This observation is consistent with the results of similar studies. This increased acidity can be explained by several pathophysiological mechanisms; the accumulation of uremic toxins in the blood plays a central role. However, other acidic compounds produced by the altered metabolism in these patients contribute to maintaining a globally acidic salivary pH.

In our population, 63% of patients had viscous saliva. This viscosity is due to a higher concentration of components like proteins and electrolytes [15].

This can be attributed to several factors; uremia, characterized by the alteration of salivary composition, makes it thicker and more viscous. Additionally, the frequent xerostomia in these patients may reduce saliva flow and increase the concentration of proteins and mucins in the saliva, thus contributing to its viscosity.

Dry mouth, which was noted in 84.8% of the studied population, is one of the common oral complications in chronic hemodialysis patients. It promotes the occurrence of carious lesions due to the alteration of the buffering capacity of saliva. A study found a prevalence of 45% of patients who complained of dry mouth in their study [16].

Decreased salivary flow rate in patients with CKD on HD is well documented in previous studies [17–20]. Dry mouth is common in dialysis patients as a result of removal of excess fluids and medications that are used [21].

In our study, we found no correlation between the DMFT index and the duration of dialysis (p=0.42). According to Kamiab et al.[22], their study also found no significant correlation between the duration of hemodialysis and the DMFT index in the patients studied. These results were corroborated by the study of Kassebaum et al., conducted in 2015 [23], which also did not observe a direct link between the duration of hemodialysis treatment and the deterioration of oral health, measured by the DMFT index.

Based on the results of the present study, there is a statistically significant relationship between the pH value and xerostomia (p=0.008). The basic nature of saliva makes the oral environment more conducive to acidity.

Salivary pH according to the duration of hemodialysis In our study, there is a significant correlation between salivary pH and the duration of dialysis (p=0.03). Salivary pH increases with the duration of hemodialysis.

On the other hand, Rodrigues RPCB et al., showed an increase in salivary pH due to the removal of uremic toxins during dialysis [24], unlike Bossola M, Tazza L, whose research concluded that salivary pH decreases after dialysis, which may be attributed to post-dialysis metabolic changes [25].

Furthermore, according to Rodrigues R.P.C.B. et al. in 2019, the reduction in salivary flow leads to a decrease in the buffering capacity of saliva, which affects the pH, making it more acidic [24]. This relationship highlights the impact of dry mouth on the acid-base balance.

The analysis of this health situation revealed that the dental care of Moroccan dialysis patients was not favorable, highlighting a significant need for dental treatment. It is essential for both dentists

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and nephrologists to receive training and incorporate oral health practices in order to promote better oral health among patients undergoing hemodialysis (HD).

5. Conclusions

The study of the DMFT index and salivary pH in hemodialysis patients highlights crucial challenges for the oral health of this population. Oral diseases are common among hemodialysis patients, worsened by their susceptibility to infections, immunosuppression, and psychological state. It is therefore imperative to implement regular and frequent dental check-ups, as well as early diagnostics for preventive purposes. Close collaboration between the dentist and the nephrologist is essential to improve their overall quality of life.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Faculty of Dental Medicine – International University of Rabat CUMD/FIMD 003/20/24.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

CKD	Chronic Kidney disease
ESRD	End-Stage Renal Disease
GFR	Glomerular filtration rate
HD	Hemodialysis
DMFT index	Decay- Missing- Filled Teeth index

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