



END-STAGE KIDNEY DISEASE AND ORAL HEALTH MEASURES

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ABSTRACT

Background: Chronic Kidney Disease (CKD) is one of the leading causes of worldwide mortality. Oral health among these patients has been found to be poor. Estimates are that oral diseases are present in almost 90% of hemodialysis patients.

Objective: the study aimed to identify the risk factors associated with oral health in ESRD patients, and then form strategies to avoid the modifiable risk factors such as educating patients about the importance of good dental care and encouraging regular dental visits.

Materials and Methodology: A cross-sectional survey was performed at a hospital in Islamabad from Dec 2023 – Feb 2024. All hemodialysis and peritoneal dialysis patients were included. A physician-administered questionnaire was administered to the participants. The data was entered into Microsoft Excel and analyzed. SPSS was used for data analysis.

Results: 54% of patients with CKD had experienced bleeding from gums, 56% patients noticed changes in their oral health after being diagnosed with ESRD, 70% of patients were following specific dietary restrictions related to CKD, 88% of patients were taking supplements for oral health, 56% of patients were also taking medications for xerostomia and other gum related problems. 64% of patients had encountered difficulty accessing dental care due to CKD. Grade 4 or severe tooth recession along with moderate gingivitis was seen in 52% of patients. 10 patients out of 50 also had severe gingivitis. The majority of patients had no knowledge about the use of dental floss.

Conclusion: the study concluded that oral health is poor in ESRD patients due to multiple contributing factors, including the disease process itself, and due to the lack of dental hygiene. Strict

preventative measures should be implemented including regular dental visits and the importance of flossing and supplementation for these patients.

Keywords: chronic kidney disease, end-stage renal disease, oral health, xerostomia

Introduction

The Kidney Disease Improving Global Outcomes (KDIGO) foundation guidelines define End-stage Kidney Disease as GFR < 15 ml/min/m², or treatment by dialysis¹. Although mortality has declined in patients with end-stage kidney disease (ESKD)², the Global Burden of Disease (GBD) studies have shown that CKD has emerged one of the leading cause of worldwide mortality^{3,4}. Hemodialysis sessions are usually prescribed for a prolonged duration, with a once, twice or thrice weekly frequency, which creates an environment of stress for patients^{5,6}. Oral health among hemodialysis patients is often compromised, primarily due to several interrelated factors. These include the neglect of oral hygiene, the fragile health condition of patients, immunosuppression resulting from advanced kidney disease, and the systemic manifestations of chronic conditions associated with end-stage kidney disease (ESKD). Patients undergoing hemodialysis frequently experience poor oral health, with notable effects on the tissues of the periodontium.⁷

One of the primary consequences of chronic kidney disease (CKD) and its treatment via hemodialysis is an increase in plaque accumulation on teeth. This heightened plaque level, combined with other risk factors, contributes to gingival hyperplasia, a condition characterized by the overgrowth of gum tissue. Moreover, these patients are at an increased risk of developing destructive periodontal disease, which leads to the breakdown of the structures supporting the teeth, as well as the formation of calculus, hardened plaque deposits that exacerbate gum inflammation and disease progression.⁷ A particularly common oral health issue among hemodialysis patients is dry mouth, or xerostomia, which is often associated with the medications prescribed to manage their condition, as well as the fluid-restricted diets they must adhere to. The long-term effects of dry mouth are significant, as it can lead to the development of additional oral health problems, including an increased risk of dental caries (tooth decay), mucosal lesions, and exacerbated periodontal disease. The lack of adequate saliva, which plays a crucial role in maintaining oral health by neutralizing acids and washing away food particles, further contributes to these issues.⁸

The prevalence of oral diseases among dialysis patients is alarmingly high, with estimates suggesting that nearly 90% of individuals undergoing dialysis suffer from some form of oral disease. These conditions not only diminish the quality of life for these patients but also pose a risk of systemic infections due to the close connection between oral and overall health. Furthermore, the severity of dental diseases has been found to correlate with the duration of hemodialysis treatment, indicating that the longer a patient remains on dialysis, the more likely they are to experience significant oral health challenges. This relationship underscores the importance of regular dental care and proactive oral hygiene practices for individuals with CKD, particularly those receiving hemodialysis.⁹

CKD is highly prevalent globally as well as in Pakistan, and is directly linked to poor oral health, this study aims to find out about the multifactorial causes, including modifiable and non-modifiable risk factors. Patients will be categorized according to the severity of CKD, and a dental check-up will be carried out on each patient to observe for signs of poor oral health, such as gingivitis and dental caries. This will help us delineate certain risk factors in CKD patients leading to poor oral health, and help health-care workers form preventative strategies for those at risk.

Materials and Methods:

A cross-sectional survey was performed to assess the dental health of hemodialysis patients. A questionnaire and a noninvasive oral examination were obtained. All hemodialysis patients registered in the dialysis programme at a hospital in Islamabad were included in the study. Patients less than 18 years of age were excluded. The study took three months to complete, December 2023 – February 2024. Informed consent was obtained from the participants. The inclusion criteria

encompassed all adult hemodialysis patients, specifically those aged 18 years and above. Patients younger than 18 years of age were excluded from the study to ensure that the results accurately reflected the adult population most affected by chronic kidney disease (CKD) and its treatment.

The consent process was conducted with care, explaining the purpose of the study, the procedures involved, and the potential benefits and risks to the participants. The primary data collection tool was a structured questionnaire, which was developed in English and subsequently translated into the local language to facilitate better understanding and accurate responses from the participants. This questionnaire was administered by a trained physician, ensuring consistency and reliability in data collection. The questionnaire was designed to capture detailed information regarding the patients' medical history, oral hygiene practices, and any symptoms or conditions related to their oral health. This approach allowed for a thorough assessment of factors potentially contributing to the oral health challenges faced by hemodialysis patients. In addition to the questionnaire, a noninvasive oral examination was performed by a qualified dental surgeon. This examination aimed to identify any clinical signs of oral health issues, such as plaque accumulation, gingival hyperplasia, periodontal disease, calculus formation, and xerostomia. The dental surgeon carefully documented these findings on a standardized proforma for each patient, ensuring that the clinical data were systematically recorded and could be accurately analyzed.

Following data collection, the information was meticulously entered into Microsoft Excel for initial organization and cleaning. The cleaned data were then imported into the Statistical Package for the Social Sciences (SPSS) for comprehensive analysis. SPSS was used to perform various statistical tests, including descriptive statistics to summarize the data, and inferential statistics to explore relationships between variables, such as the correlation between the duration of hemodialysis and the severity of dental diseases.

Results:

The study included a total of 50 participants, comprising 28 males (56%) and 22 females (44%). Table 1 shows the age distribution of the participants: 29 (58%) are aged 60-80 years, 13 (26%) are aged 40-60 years, and 8 (16%) are aged 20-40 years.

Table 1: Participant Demographics

Demographic	Category	N (%)
Total Participants	N(%)	50 (100%)
Gender	Male	28 (56%)
	Female	22 (44%)
Age Range	20-40	8 (16%)
	40-60	13 (26%)
	60-80	29 (58%)

Table 2 details the dialysis and oral health practices of the participants. A majority of participants have been on dialysis for less than 2 years (56%), with 34% having been on dialysis for 2-5 years and 10% for more than 5 years. Only 4% have received a kidney transplant, and 96% are still on dialysis. The type of dialysis used is predominantly hemodialysis (92%), with 8% on peritoneal dialysis. Dental visit frequency reveals that 42% visit the dentist every 3+ years, 14% never visit, and only 14% visit every 6-12 months. Regarding brushing habits, 38% brush less than once a day, 36% brush once a day, 14% brush twice a day, and 12% brush more than twice a day. The toothbrush type predominantly used is hard (42%), followed by medium (24%), soft (10%), and 24% are unsure. Most participants do not use fluoride toothpaste (68%) or mouthwash (64%). Regular flossing or the use of interdental brushes is uncommon, with 64% of participants not engaging in these practices. Special oral hygiene aids prescribed by dentists are used by 48% of participants, while 52% do not use them. Dry mouth or reduced salivary flow affects 44% of participants. Bleeding from the gums is reported by 54%, and 42% experience tooth sensitivity.

Toothaches or dental pain are reported by 48%, and 24% have noticed changes in their tongue or mouth appearance. Since being diagnosed with ESRD, 56% have observed changes in their oral health. Dietary restrictions related to kidney disease are followed by 70% of participants. A majority (66%) do not have a regular dentist or dental specialist aware of their ESRD, and 64% have postponed or avoided dental visits due to their medical condition. Medications or supplements affecting oral health are taken by 88%, and 56% are on medications for dry mouth or gum problems. Challenges in accessing dental care due to kidney disease are faced by 64%, and 90% do not have insurance or coverage for dental care related to their kidney disease. Additionally, 72% of participants do not consume a lot of acidic or sugary foods and beverages.

Table 2: Dialysis and Oral Health Practices

Category	Option	N (%)
Years on Dialysis	< 2 years	28 (56%)
	2-5 years	17 (34%)
	> 5 years	5 (10%)
Kidney Transplant	Yes	2 (4%)
	No	48 (96%)
Type of Dialysis	Hemodialysis	46 (92%)
	Peritoneal Dialysis (PD)	4 (8%)
Frequency of Dental Visits	Every 6-12 months	7 (14%)
	Every 1-2 years	15 (30%)
	Every 3+ years	21 (42%)
	Never	7 (14%)
Brushing Frequency	1 time/day	18 (36%)
	2 times/day	7 (14%)
	< 1 time/day	19 (38%)
	> 2 times/day	6 (12%)
Toothbrush Type	Soft	5 (10%)
	Medium	12 (24%)
	Hard	21 (42%)
	Don't know	12 (24%)
Use of Fluoride Toothpaste	Yes	7 (14%)
	No	9 (18%)
	Don't know	34 (68%)
Use of Mouthwash	Yes	8 (16%)
	No	10 (20%)
	Don't know	32 (64%)
Flossing or Interdental Brushes	Yes	11 (22%)
	No	7 (14%)
	Don't know	32 (64%)
Special Oral Hygiene Aids	Yes	13 (26%)
	No	11 (22%)
	Don't know	26 (52%)
Dry Mouth or Reduced Salivary Flow	Yes	22 (44%)
	No	28 (56%)
Bleeding from Gums	Yes	27 (54%)
	No	23 (46%)
Tooth Sensitivity	Yes	21 (42%)
	No	29 (58%)
Toothaches or Dental Pain	Yes	24 (48%)
	No	26 (52%)
Changes in Tongue or Mouth Appearance	Yes	12 (24%)

	No	38 (76%)
Changes in Oral Health Since ESRD Diagnosis	Yes	28 (56%)
	No	22 (44%)
Dietary Restrictions for Kidney Disease	Yes	35 (70%)
	No	15 (30%)
Regular Dentist or Specialist Awareness of ESRD	Yes	17 (34%)
	No	33 (66%)
Postponed or Avoided Dental Visits	Yes	32 (64%)
	No	18 (36%)
Medications or Supplements Affecting Oral Health	Yes	44 (88%)
	No	6 (12%)
Medications for Dry Mouth or Gum Problems	Yes	28 (56%)
	No	22 (44%)
Challenges Accessing Dental Care	Yes	32 (64%)
	No	18 (36%)
Insurance or Coverage for Dental Care	Yes	5 (10%)
	No	45 (90%)
Consumption of Acidic or Sugary Foods	Yes	14 (28%)
	No	36 (72%)

Table 3 presents the dental checkup findings. Normal tooth mobility is observed in 48% of participants, 22% have mild mobility, and 30% have extractable mobility. Tooth erosion is present in 44% of participants, while 56% do not experience erosion. Severe tooth recession (Grade 4) is noted in 52% of participants, with 24% having normal recession and 10% with moderate recession. Gingivitis is moderate in 52% of participants, mild in 28%, and severe in 20%. Probing pocket depth measurements indicate that 32% have severe probing pocket depth (>6mm), 24% have moderate depth (5mm), and 26% have mild depth (4mm). The calculus surface index shows that 54% have moderate calculus, 28% have severe calculus, and 18% have mild calculus. The Papillary Bleeding Index (PBI) reveals that 58% have Grade 2 bleeding, 24% have Grade 1 bleeding, and 18% have Grade 3 bleeding. Clinical attachment loss is observed as 4-5 mm in 40% of participants, 3 mm in 34%, 2 mm in 16%, and 6-7 mm in 10%. Regarding dental caries, 46% have 2-4 caries, 38% have fewer than 2, and 16% have more than 4. The clinical attachment level is above the cemento-enamel junction in 54% of participants, normal in 28%, and below the cemento-enamel junction in 18%.

Table 3: Dental Checkup Findings

Category	Option	N (%)
Tooth Mobility	Grade 1 (Normal)	24 (48%)
	Grade 2 (Mild)	11 (22%)
	Grade 3 (Extractable)	15 (30%)
Tooth Erosion	Yes	22 (44%)
	No	28 (56%)
Tooth Recession	Grade 1 (Normal)	12 (24%)
	Grade 2 (Mild)	7 (14%)
	Grade 3 (Moderate)	5 (10%)
	Grade 4 (Severe)	26 (52%)
Gingivitis	Mild	14 (28%)
	Moderate	26 (52%)
	Severe	10 (20%)
Probing Pocket Depth	< 3mm (Normal)	9 (18%)
	4 mm (Mild)	13 (26%)

	5 mm (Moderate)	12 (24%)
	> 6mm (Severe)	16 (32%)
Calculus Surface Index	Mild	9 (18%)
	Moderate	27 (54%)
	Severe	14 (28%)
Papillary Bleeding Index (PBI)	Grade 1	12 (24%)
	Grade 2	29 (58%)
	Grade 3	9 (18%)
Clinical Attachment Loss	2 mm	8 (16%)
	3 mm	17 (34%)
	4-5 mm	20 (40%)
	6-7 mm	5 (10%)
Dental Caries	< 2	19 (38%)
	2-4	23 (46%)
	> 4	8 (16%)
Clinical Attachment Level	Normal	14 (28%)
	Above Cementoenamel Junction	27 (54%)
	Below Cementoenamel Junction	9 (18%)

Discussion

Dry mouth (xerostomia and hyposalivation) is highly prevalent in ESRD patients^{8,10}. Dry mouth in ESRD patients may be caused by the dialysis procedure, fluid restricted diet, use of multiple medications with dry mouth as a side effect and/or salivary gland fibrosis and atrophy. A deficiency of saliva may have several consequences for patients. They may lead to problems with speaking, chewing and swallowing, gustatory alterations, heightened risk of oral infections, halitosis (bad breath) such as candidiasis, increased incidence of caries which progress rapidly, and periodontal disease, as well as an increased risk of fluid intake to counter the dry mouth feeling leading to interdialytic weight gain and hypertension^{8,11}. Diabetes mellitus was seen to be a contributing factor for xerostomia, and patients with poor glycemic control experienced greater oral dryness than patients with optimal glycemic indices. High blood glucose levels lead to the excretion of large urine volumes, which in turn leads to a decline in intravascular fluid and hence an increase in the sensation of oral dryness. Impaired immune responses may result in an altered reaction to periodontal Gram-negative bacteria, potentially enabling these bacteria to take over the subgingival microbiome and induce the breakdown of the periodontium. Careful treatment of oral problems prior to transplantation after examination of the oral cavity and may be part of the pretransplant procedure. Xerostomia and hyposalivation were highly prevalent in ESRD patients, as also seen in our study⁸.

In further comparison with different studies conducted, it was seen that dental care in patients undergoing hemodialysis was neglected, and that they brushed and flossed infrequently, as also seen in our study which showed that only 11 patients used dental floss and 32 patients did not know about flossing. Results of a study by Naugle et al. suggested that 100% ($n = 45$) of the individuals undergoing hemodialysis presented with some form of periodontal disease. Moreover, diabetic ESRD patients show deeper periodontal pockets compared with ESRD nondiabetic patients. Also, the need for surgical treatment of periodontitis is significantly higher in patients awaiting kidney transplant compared with patients not awaiting organ transplantation¹².

The oral condition of patients with renal failure has been described comprehensively in a recent meta-analysis by Ruospo et al. in which the authors compared the prevalence of oral diseases in adults with non-dialysis-dependent CKD, ESRD plus hemodialysis, and transplantation and explored the association between oral disease and mortality^{12,13}. Gavaldá et al. examined the oral mucosa of 105 patients with chronic renal failure and noted uremic stomatitis, mucosal lesions and candidal infections occurring in 37% of patients. Klassen and Krasko examined 45 patients undergoing hemodialysis and reported that all of them presented with some degree of periodontal

disease, 64% had severe gingivitis and 28% had early periodontitis regardless of the duration of dialysis. In another study, examining 44 patients undergoing hemodialysis, Wilson and Kornman reported, periodontal disease (i.e. severe gingivitis and ulcers) was present in all cases. In another study conducted in Pakistan, 73 % of patients had periodontitis, 83 % had varying levels of plaque and tartar buildup and only 1 % had gingival bleeding¹⁴. In another study, it was seen that 24.3% patients had periodontal pocket depth of 4 to 5mm while 0.4% had the pocket depth of 6mm or more¹⁵ whereas in our study 16 patients had an increased depth of > 6 mm.

CONCLUSION

Our study show that oral health is poor in ESRD patients and it continues to deteriorate either due to chronic disease factors, or patient factors including poor hygiene or lack of dental visits. Multiple reasons contribute to the above and by conducting this study, we aim to identify the modifiable risk factors, and implementing them to stop or at least hinder the progression of poor oral health which lead to patients' morbidity and increased costs of healthcare. Some of the measures would include emphasizing regular dental visits and the importance of flossing and supplementation for these patients.

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