

Impact of Dialysis on Periodontal and General Oral Health of Chronic Kidney Disease Patients

HAFSA NOOR¹, WAQAS MIRZA², MARIAH MUHAMMAD ARSHAD³, RABIA ARSHAD⁴, FAIQA SHAFQAT⁵, DARAB FATIMA BABARY⁶, HIRA BUTT⁷

¹House officer, College of Dentistry, Sharif Medical and Dental College, Lahore

²Demonstrator, Department of Oral Medicine, College of Dentistry, Sharif Medical and Dental College, Lahore

³General Dental Practitioner, Lahore

^{4,5,6}House officer, College of Dentistry, Sharif Medical and Dental College, Lahore

⁷Demonstrator, Oral Pathology Department, College of Dentistry, Sharif Medical and Dental College, Lahore

Corresponding author: Hira Butt, Email: hira.ah.butt@gmail.com, Cell: 0336-7160357

ABSTRACT

Objective: To assess the impact of dialysis on periodontal and general oral health of chronic kidney disease patients.

Methodology: A Cross sectional comparative study was conducted in the department of Nephrology and Urology, Sharif Medical and Dental College, Lahore on 32 patients with chronic kidney disease in the time duration of one year. Chronic kidney disease stage 3, 4 and 5 patients with age above 18 years, belonging to both the genders and same socioeconomic status were a part of the study. Data collection was based on the following parameters: Community Periodontal Index of Treatment Needs (CPITN).

Results: There was a statistically non-significant association between stage of chronic kidney disease and periodontal health of patients undergoing dialysis ($p=0.185$) and general oral health ($p=0.120$).

Practical Implication: This study will help dental practitioners understand the impact of renal dialysis on general oral and periodontal health of patients with chronic kidney disease and in turn help them provide effective health care to these patients who have specialized treatment needs.

Conclusion: It was seen that stage 3 patients had the highest percentage of bleeding gums while none had periodontal pockets nor calculus deposition. Stage 4 patients had an equal percentage of calculus deposition and periodontal pocket depth of 4-5 mm. Stage 5 patients had a high percentage of Periodontal pocket depths of 4-5mm followed by calculus and then bleeding gums. A higher percentage of stage 3 and 5 patients undergoing dialysis had a high DMFT whereas the percentage of stage 4 patients with high and low DMFT scores was equal.

Keywords: Dialysis, Chronic kidney disease, periodontal health, Community periodontal index for treatment needs (CPITN)

INTRODUCTION

CKD is a long term, progressive condition in which kidneys cannot filter blood from excess body fluids and wastes causing health problems. It is more prevalent in old age patients with diabetes and hypertension¹. CKD affects more than 10% people globally². Periodontitis is a common inflammatory oral disease that cause gradual destruction of periodontal apparatus. Radiographic picture of periodontitis shows alveolar bone resorption, clinically gingival inflammation, bleeding on probing, clinical attachment loss and teeth mobility are observed³. Accumulation of pathogenic oral microbiome and release of destructive enzymes that includes proteases, lipases, nucleases have a devastating effect on teeth supporting apparatus⁴. Chronic kidney disease (CKD) and chronic periodontitis (CP) are commonly found worldwide health issue, 200 possible connections between systemic diseases and oral health have been found by American dental association⁵. Patients with chronic kidney disease show progressive decline in renal function, structural and functional efficacy of the kidney is affected hence reducing the glomerular filtration rate by GFR less than 60 ml/min/1.73m² for time period of 3 months^{6,7}. When compared to the general population It has been observed that the patients suffering from chronic kidney disease are at higher risk of developing oral health problems that includes periodontal disease, increased probability of having calculus due to poor oral hygiene, xerostomia which can increase incidence of caries activity in teeth, teeth mobility and early tooth loss, calcification of pulp chamber leading to narrowing of the pulp canal⁸. Most common therapeutic modality for the patients suffering from chronic kidney disease is hemodialysis. It is the procedure in which harmful toxins and nitrogenous wastes are removed from body. It has proved to be a lifesaving intervention⁷ susceptibility of getting infections in patients who undergo dialysis or renal transplantation is higher due to immune system dysfunction, dysfunctioning of the cells involved in immunity i.e. lymphocytopenia and lymphocytes function is reduced, phagocytosis and chemotaxis by neutrophils is also weakened⁹. Lipopolysaccharide coats of the bacteria involved in periodontitis can also induce systemic inflammation that triggers formation of thrombi, aggregation of platelets and atherosclerosis

However, risk factor i.e. periodontitis is completely modifiable and treatable^{10,11}. This study will help dental practitioners understand the impact of renal dialysis on general oral and periodontal health of patients with chronic kidney disease and in turn help them provide effective health care to these patients who have specialized treatment needs.

The aim of this study was to assess the impact of dialysis on periodontal and general oral health of chronic kidney disease patients.

METHODOLOGY

A Cross sectional comparative study was conducted in the department of Nephrology and Urology, Sharif Medical and Dental College, Lahore on 32 patients with chronic kidney disease in the time duration of one year. The study was conducted after ethical approval certificate No. SMDC/SMRC/100-19 from Sharif Medical Research Centre (SMRC). Keeping the precision at 15% and prevalence of chronic kidney disease 3.5%¹² and confidence level 95%, the same size was calculated to be 50.

Chronic kidney disease stage 3, 4 and 5 patients with age above 18 years, belonging to both the genders and same socioeconomic status were a part of the study. Patients undergoing renal dialysis for reasons other than CRF, those who were critically ill and those with any systemic illnesses were excluded from the study.

Data was collected after taking an informed consent from the patients. The demographic data along with a list of variables associated with chronic kidney disease was recorded using a structured questionnaire. Data collection was based on the following parameters: Community Periodontal Index of Treatment Needs (CPITN). The data was analyzed using IBM SPSS Statistics 23. P value ≤ 0.05 was considered significant. Numeric data was presented as mean and its respective standard deviation. Nominal data was presented as frequency and percentages. Fisher exact test was used to find the association between periodontal and general oral health of chronic kidney disease patients undergoing dialysis.

RESULTS

A cross sectional study was performed on patients with chronic kidney disease out which 10 were stage 3, 11 were stage 4 and 29 were stage 5 patients. The mean age of the 38.08±17.042 years with 55.6% males and 44.6% females.

Table 1 shows a statistically non-significant association between stage of chronic kidney disease and periodontal health of patients undergoing dialysis (p=0.185). It was seen that stage 3 patients had the highest percentage of bleeding gums while none had periodontal pockets nor calculus deposition. Stage 4 patients had an equal percentage of calculus deposition and periodontal pocket depth of 4-5 mm. Stage 5 patients had a high percentage of Periodontal pocket depths of 4-5mm followed by calculus and then bleeding gums as shown in table 1.

Table 1: Association between periodontal health and stage of chronic kidney disease in patients undergoing dialysis

Chronic kidney disease patients on dialysis	Periodontal health			P value
	Bleeding gums	Calculus	Pocket depth 4-5mm	
STAGE 3	1 (100%)	0 (0%)	0 (0%)	0.185
STAGE 4	0 (0%)	1 (50%)	1 (50%)	
STAGE 5	1 (4.5%)	9 (40.9%)	12 (54.5%)	

Table 2 shows a non-significant association between general oral health and stage of chronic kidney disease patients undergoing dialysis (p=0.120). It was seen that a higher percentage of stage 3 and 5 patients undergoing dialysis had a high DMFT whereas the percentage of stage 4 patients with high and low DMFT scores was equal as shown in table 2.

Table 2: Association between general oral health and stage of chronic kidney disease in patients undergoing dialysis

Chronic kidney disease patients on dialysis	General Oral Health		P value
	High score (DMFT)	Low score (DMFT)	
STAGE 3	1 (100%)	0 (0%)	0.120
STAGE 4	1 (50%)	1 (50%)	
STAGE 5	22 (100%)	0 (0%)	

DISCUSSION

According to the earlier studies it has been found that Pakistani population having a mean age of 30 years are found to have a decline in functioning of kidneys^{13,14}. It is reported that particularly in kidney disease patients undergoing hemodialysis have a high DMFT score, alveolar bone loss and poor oral hygiene^{15,16}. Up to 90% of the patients with renal disease show oral symptoms that is estimated by the researchers¹⁷. Meta-analysis by Ruospo et al. comprehensively describes oral conditions of patients with renal disease. DMFT indices were high in adults suffering from chronic kidney disease CKD¹⁸. In a recent meta-analysis by Ruospo et al.²⁹ two studies shows 42% of 617 adults and 6.4% of 2303 with CKD stages 1-5 have been reported with edentulism. Studies not modified by age, gender, time on dialysis and geographical region show 1516 patients with CKD stage 5D, 20.6%(CI, 16.4-25.6%) were affected by edentulism²¹⁻³⁰. In adults with CKD stages 1-5 the mean DMFT index was found to be moderate to high (range, 11.3 and 24.9) in three studies (n=111, mean population age 45 years)³¹⁻³³ and in adult patients with CKD stage 5D it was between 6.6 and 26 (28 populations; n = 1345, mean population age 50 (CI 47–54) years)^{23,24,34-41}.

According to our study, it was seen that stage 3 patients had the highest percentage of bleeding gums (100%) while none had periodontal pockets nor calculus deposition. Stage 4 patients had an equal percentage of calculus deposition (50%) and periodontal pocket depth of 4-5 mm (50%). Stage 5 patients had a high percentage of Periodontal pocket depths of 4-5mm (54.5%) followed by calculus (40.9%) and then bleeding gums (4.5%).

The mean DMFT index in one kidney transplant population was 25.7 (n=9; mean population age 50 years)³³. Summarizing the above analyses shows that in adults with CKD Stages 1–5 [18.7

(CI, 10.5–27.0)] and those with CKD Stage 5D [14.5 (CI, 12.7–16.3)] (P for subgroup difference = 0.29) DMFT indices were similarly high. In adults with CKD Stage 5D The mean DMFT index increased with age (meta-regression P = 0.001), but was not associated with duration of dialysis or gender.

According to our study a higher percentage of stage 3 and 5 patients undergoing dialysis had a high DMFT whereas the percentage of stage 4 patients with high and low DMFT scores was equal.

A cross-sectional study conducted by GCKD study in Germany revealed an overall prevalence of about 47.6% for cases of moderate periodontitis and about 27% for severe periodontitis according to the CDC/AAP criteria⁴². Mostly commonly reported oral health problems among these patients were found to be oral dryness, halitosis, mucosal changes in tongue⁴².

Limitation: A larger sample size and multicenter study would have helped us unravel more findings.

CONCLUSION

It was seen that stage 3 patients had the highest percentage of bleeding gums while none had periodontal pockets nor calculus deposition. Stage 4 patients had an equal percentage of calculus deposition and periodontal pocket depth of 4-5 mm. Stage 5 patients had a high percentage of Periodontal pocket depths of 4-5mm followed by calculus and then bleeding gums. A higher percentage of stage 3 and 5 patients undergoing dialysis had a high DMFT whereas the percentage of stage 4 patients with high and low DMFT scores was equal.

REFERENCES

- Kalantar-Zadeh K, Jafar TH, Nitsch D, Neuen BL, Perkovic V. Chronic kidney disease. *The lancet*. 2021 Aug 28;398(10302):786-802.
- Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. *Kidney Int. Suppl.* 2022 Apr 1;12(1):7-11.
- Papapanou PN, Sanz M, Buduneli N, Dietrich T, Feres M, Fine DH, Flemmig TF, Garcia R, Giannobile WV, Graziani F, Greenwell H. Periodontitis: Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J. Periodontol.* 2018 Jun;89:S173-82.
- Page RC, Schroeder HE. Pathogenesis of inflammatory periodontal disease. A summary of current work. *Lab Invest.* 1976 Mar 1;34(3):235-49.
- Bokhari SA, Khan AA. Growing burden of noncommunicable diseases: the contributory role of oral diseases, Eastern Mediterranean Region perspective. *East Mediterr Health J.* 2009; 15 (4), 1011-1020.
- Obrador GT, Pereira BJ. Systemic complications of chronic kidney disease: Pinpointing clinical manifestations and best management. *Postgraduate medicine.* 2002 Feb 1;111(2):115-22.
- Glick M. *Burket's oral medicine.* PMPH USA; 2015.
- Davidovich E, Schwarz Z, Davidovitch M, Eidelman E, Bimstein E. Oral findings and periodontal status in children, adolescents and young adults suffering from renal failure. *J. Clin. Periodontol.* 2005 Oct;32(10):1076-82.
- Borawski J, Wilczyńska-Borawska M, Stokowska W, Myśliwiec M. The periodontal status of pre-dialysis chronic kidney disease and maintenance dialysis patients. *Nephrol Dial Transplant.* 2007 Feb 1;22(2):457-64.
- Craig RG, Kotanko P, Kamer AR, Levin NW. Periodontal diseases—a modifiable source of systemic inflammation for the end-stage renal disease patient on haemodialysis therapy?. *Nephrol Dial Transplant.* 2007 Feb 1;22(2):312-5.
- Craig RG, Spittle MA, Levin NW. Importance of periodontal disease in the kidney patient. *Blood Purif.* 2002;20(1):113-9.
- Hasan M, Sutradhar I, Gupta RD, Sarker M. Prevalence of chronic kidney disease in South Asia: a systematic review. *BMC Nephrol.* 2018 Dec;19(1):1-2.
- Hasnain J, Memon GN, Memon A, Channa AA, Creswell J, Shah SA. Screening for HIV among tuberculosis patients: a cross-sectional study in Sindh, Pakistan. *BMJ open.* 2012 Jan 1;2(5):e001677.
- Jafar TH. Blood pressure, diabetes, and increased dietary salt associated with stroke—results from a community-based study in Pakistan. *J. Hum. Hypertens.* 2006 Jan;20(1):83-5.

- 15 Brito F, Almeida S, Figueredo CM, Bregman R, Suassuna JH, Fischer RG. Extent and severity of chronic periodontitis in chronic kidney disease patients. *J. Periodontol Res.* 2012 Aug;47(4):426-30.
- 16 da Silva Guerra EN, Vianna L, Sobreira MN, de Araújo FN, de Melo NS. Oral manifestations of hyperoxaluria. *J Craniofac Surg.* 2011 Nov 1;22(6):2191-2.
- 17 De Rossi SS, Glick M. Dental considerations for the patient with renal disease receiving hemodialysis. *J Am Dent Assoc.* 1996 Feb 1;127(2):211-9.
- 18 Ruospo M, Palmer SC, Craig JC, Gentile G, Johnson DW, Ford PJ, Tonelli M, Petrucci M, De Benedittis M, Strippoli GF. Prevalence and severity of oral disease in adults with chronic kidney disease: a systematic review of observational studies. *Nephrol. Dial. Transplant.* 2014 Feb 1;29(2):364-75.
- 19 Fisher MA, Taylor GW, Shelton BJ, Jamerson KA, Rahman M, Ojo AO, Sehgal AR. Periodontal disease and other nontraditional risk factors for CKD. *Am J Kidney Dis.* 2008 Jan 1;51(1):45-52.
- 20 Ioannidou E, Swede H, Dongari-Bagtzoglou A. Periodontitis predicts elevated C-reactive protein levels in chronic kidney disease. *J. Dent. Res.* 2011 Dec;90(12):1411-5.
- 21 Bots CP, Brand HS, Veerman EC, Valentijn-Benz M, Van Amerongen BM, Valentijn RM, Vos PF, Bijlsma JA, Bezemer PD, Ter Wee PM, Amerongen AV. Interdialytic weight gain in patients on hemodialysis is associated with dry mouth and thirst. *Kidney international.* 2004 Oct 1;66(4):1662-8.
- 22 Bouattar T, Chbicheb S, Benamar L, El Wady W, Bayahia R. Dental status in 42 chronically hemodialyzed patients. *Revue de stomatologie et de chirurgie maxillo-faciale.* 2010 Nov 24;112(1):1-5.
- 23 Buhlin K, Barany P, Heimbürger O, Stenvinkei P, Gustafsson A, Stenvinkel P. Oral health and pro-inflammatory status in end-stage renal disease patients. *Oral Health Prev Dent.* 2007 Jun 1;5(3).
- 24 Chamani G, Zarei MR, Radvar M, Rashidfarrokhi F, Razazpour F. Oral health status of dialysis patients based on their renal dialysis history in Kerman, Iran. *Oral health prev Dent.* 2009 Jan 1;7(3):269-75.
- 25 de la Rosa Garcia E, Mondragon padilla A, Aranda romo S, Bustamante Ramirez MA. Oral mucosa symptoms, signs and lesions, in end stage renal disease and non-end stage renal disease diabetic patients. *Med Oral Patol Oral Cir.* 2006 Nov;11(6):467-73.
- 26 Gürkan A, Köse T, Atilla G. Oral health status and oral hygiene habits of an adult Turkish population on dialysis. *Oral Health Prev Dent.* 2008 Jan 1;6(1).
- 27 Klassen JT, Krasko BM. The dental health status of dialysis patients. *J Can Dent Assoc.* 2002 Jan 1;68(1):34-8.
- 28 Montagnac R, Delagne JM, Schillinger D, Schillinger F. Dental problems and their management in uraemic patients. *NEPHROL THER.* 2006 Nov 28;2(7):436-41.
- 29 Perneger TV, Whelton PK, Klag MJ. Race and end-stage renal disease: socioeconomic status and access to health care as mediating factors. *Arch. Intern. Med.* 1995 Jun 12;155(11):1201-8.
- 30 Ziebolz D, Fischer P, Hornecker E, Mausberg RF. Oral health of hemodialysis patients: A cross-sectional study at two German dialysis centers. *Hemodial Int.* 2012 Jan;16(1):69-75.
- 31 Garcez J, Posse JL, Carmona IT, Feijoo JF, Dios PD. Oral health status of patients with a mild decrease in glomerular filtration rate. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009 Feb 1;107(2):224-8.
- 32 Sobrado Marinho JS, Tomás Carmona I, Loureiro A, Limeres Posse J, García Caballero L, Diz Dios P. Oral health status in patients with moderate-severe and terminal renal failure. *Medicina Oral, Patología Oral y Cirugía Bucal (Internet).* 2007 Aug;12(4):305-10.
- 33 Vesterinen M, Ruokonen H, Leivo T, Honkanen AM, Honkanen E, Karl K, Lindqvist C, Meurman JH. Oral health and dental treatment of patients with renal disease. *Quintessence Int.* 2007 Mar 1;38(3).
- 34 Al-Wahadni A, Al-Omari MA. Dental diseases in a Jordanian population on renal dialysis. *Quintessence Int.* 2003 May 1;34(5).
- 35 Bayraktar GÖ, Kazancioglu R, Bozfakioglu S, Yıldız A, Ark E. Evaluation of salivary parameters and dental status in adult hemodialysis patients. *Clin. Nephrol.* 2004 Nov 1;62(5):380-3.
- 36 Bayraktar G, Kurtulus I, Kazancioglu R, Bayramgurler I, Cintan S, Bural C, Bozfakioglu S, Issever H, Yıldız A. Oral health and inflammation in patients with end-stage renal failure. *Perit Dial Int.* 2009 Jul;29(4):472-9.
- 37 Bots CP, Brand HS, Poorterman JH, van Amerongen BM, Valentijn-Benz M, Veerman EC, ter Wee PM, Nieuw Amerongen AV. Oral and salivary changes in patients with end stage renal disease (ESRD): a two year follow-up study. *Br. Dent. J.* 2007 Jan 27;202(2):E7-.
- 38 Bots CP, Poorterman JH, Brand HS, Kalsbeek H, Van Amerongen BM, Veerman EC, Nieuw Amerongen AV. The oral health status of dentate patients with chronic renal failure undergoing dialysis therapy. *Oral Dis.* 2006 Mar;12(2):176-80.
- 39 Cengiz MI, Sümer P, Cengiz S, Yavuz U. The effect of the duration of the dialysis in hemodialysis patients on dental and periodontal findings. *Oral Dis.* 2009 Jul;15(5):336-41.
- 40 Chuang SF, Sung JM, Kuo SC, Huang JJ, Lee SY. Oral and dental manifestations in diabetic and nondiabetic uremic patients receiving hemodialysis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005 Jun 1;99(6):689-95.
- 41 Gavalda C, Bagán JV, Scully C, Silvestre FJ, Milián MA, Jimenez Y. Renal hemodialysis patients: oral, salivary, dental and periodontal findings in 105 adult cases. *Oral Dis.* 1999 Jul;5(4):299-302.
- 42 Dannewitz B, Sommerer C, Stölzel P, Baid-Agrawal S, Nadal J, Bärthlein B, Wanner C, Eckardt KU, Zeier M, Schlagenhauf U, Krane V. Status of periodontal health in German patients suffering from chronic kidney disease—Data from the GCKD study. *J. Clin. Periodontol.* 2020 Jan;47(1):19-29.