

# Comparative Evaluation of General Oral and Periodontal Health Status of Chronic Kidney Disease (CKD) patients in Various Stages admitted to Sharif Medical and Dental College, Lahore, and Healthy Controls

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## ABSTRACT

**Objective:** To assess the general oral and periodontal health status of chronic kidney disease patients in various stages and compare it to healthy controls.

**Methodology:** A Cross-sectional comparative study was conducted in Sharif Medical and Dental College, Lahore on 50 patients with chronic kidney disease and 58 controls for the time duration of one year. Data collection was based on the Community Periodontal Index of Treatment Needs and Decayed Missing and Filled index.

**Results:** There was a significant association between stage of kidney disease and periodontal health ( $p \leq 0.001$ ) and general oral health as determined by the DMFT index ( $\leq 0.001$ ). There was a significant difference in the scores of decayed teeth between the controls and stage 3 (0.042), stage 5 ( $\leq 0.001$ ) and stage 4 ( $p = 0.001$ ). The difference in the scores of missing teeth was significant between controls and stage 5 ( $p \leq 0.001$ ) and stage 4 ( $p = 0.001$ ). Similar was the case for decayed missing and filled teeth index scores for controls and stage 3 ( $p = 0.013$ ), stage 5 ( $\leq 0.001$ ) and stage 4 ( $\leq 0.001$ ).

**Conclusion:** Bleeding gums were most common in stage 3 while pocket depths of 4-5mm were highest in stage 4 and 5 patients. Pocket depth of 4 to 5mm was the most prevalent periodontal problem in controls. In the controls, more individuals had a high DMFT score in comparison to low scores. The scores of decayed teeth and decayed missing filled index were significantly different among the controls and stages 3, 5 and 4 while for missing teeth score, the difference was significant between controls and stages 4 and 5.

**Keywords:** Periodontal health, Community periodontal index for treatment needs (CPITN), Decayed missing and filled teeth (DMFT) index, chronic kidney disease.

## INTRODUCTION

Periodontal health is defined as a state free of any periodontal disease both clinically and histologically<sup>1</sup>. It is characterized by the absence of inflammation in periodontal tissues. Periodontal disease is a complex oral health issue of that is precipitated by alteration in host immunity, oral microflora and environmental factors<sup>2</sup>. Host determinants of clinical periodontal health are categorized into local and systemic factors. Local predisposing factors include: periodontal pockets, dental restorations and root anatomy while systemic factors include host immune function, systemic health and genetic makeup of host<sup>2, 3</sup>. Environmental determinants including smoking, medications, stress and nutrition also predispose to periodontal disease.

A relationship between oral health and general well being and health of individuals has been reported in the past. Among the systemic diseases, renal disease has been shown to affect not only the general health of the patient but also oral and periodontal health<sup>4</sup>. Multiple causes have been proposed to explain this correlation one of which is reduced immune response to microbial organisms. In addition to this these patients have difficulty in maintaining good oral hygiene because of the intense psychological burden and time-consuming treatment sessions. Additional variables are age, associated systemic disease, dialysis vintage and lack of access to dental care services. Renal disease is classified into five stages on the basis of their functional efficiency determined by Glomerular Filtration Rate (GFR). Stage 1 renal disease has normal function with GFR  $>90$ , stage 2 has mildly decreased function with GFR 60-89%, stage 3 has moderately decreased function with GFR 30-59%, stage 4 has severely decreased function with GFR 15-29% and stage 5 renal disease is kidney failure with GFR  $<15\%$ <sup>5</sup>.

Studies have reported a strong association between periodontitis and renal disease<sup>6, 7</sup>. However such study has not been conducted in our region. It will help the clinicians and patient to understand the effect of renal disease on general oral and periodontal health and will improve the quality of life of such

patients. The aim of this study was to assess the general oral and periodontal health status of chronic kidney disease (CKD) patients in various stages and compare it to healthy controls.

## METHODOLOGY

A Cross sectional comparative study was conducted in Sharif Medical and Dental College, Lahore on 50 patients with chronic kidney disease and 58 healthy controls from August 2019 to August 2020. The study was conducted after ethical approval certificate No. SMDC/SMRC/100-19 from Sharif Medical Research Centre (SMRC). The sampling technique employed was convenient sampling. The sample size was calculated to be 58, keeping the precision at 15% and prevalence of chronic kidney disease 3.5%<sup>8</sup> and confidence level 95%, the same size was calculated to be 50. Informed consent was taken from patients prior to data collection.

Chronic kidney disease patients irrespective of their gender and stage of disease who were 18 years of age were included in the study. The patients who had any other systemic illness and those undergoing renal dialysis for any reason besides chronic kidney disease were excluded from the study. Controls were included irrespective of their gender, were free of chronic kidney disease and were above 18 years of age. The controls who had any other systemic illness, those who had a past medical history or family history of chronic kidney disease were excluded from the study.

The collected data was recorded in a specialized proforma. Community Periodontal Index of Treatment Needs (CPITN) and Decayed Missing and Filled index (DMFT) were used for assessing the periodontal and general oral health respectively of patients and controls. The data was analyzed using IBM SPSS Statistics 23. P value  $\leq 0.05$  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 participants with and without chronic kidney

disease. Kruskal Wallis test was used to find the difference in the mean rank score of the decayed teeth, missing teeth, filled teeth, decayed missing filled teeth (DMFT) index score and Community periodontal index for treatment needs (CPITN) among the stages of chronic kidney disease and controls. Multiple comparison post hoc tests were also done for Kruskal Wallis test.

**RESULTS**

This study was conducted on 108 participants with 50 patients of chronic kidney disease and 58 disease free controls. The mean age of the participants was 38.08±17.042 years with 55.6% males

and 44.4% females. Among the patients of chronic kidney disease 9.3% belonged to stage 3, 10.2% to stage 4 and 26.9% belonged to stage 5 chronic kidney disease.

Table 1 shows a statistically significant association between periodontal health and stage of kidney disease and healthy controls. It was seen that among the stages of kidney disease bleeding gums were the most common in stage 3 while pocket depths of 4-5mm were the highest in stage 4 and 5 patients. Furthermore, it was seen that Pocket depth of 4 to 5mm was the most prevalent periodontal problem in disease free controls as shown in table 1.

Table 1: Association of Periodontal Health with the Stages of Chronic Kidney Disease

Stage of kidney disease	Community Periodontal Index For Treatment Needs (CPITN)				P value
	Healthy n (%)	Bleeding n (%)	Calculus n (%)	Pocket Depth 4-5MM n (%)	
Stage 3	1 (0.9%)	5 (4.6%)	0 (0.0%)	4 (3.7%)	≤0.001
Stage 4	1 (0.9%)	0 (0.0%)	3 (2.8%)	7 (6.5%)	
Stage 5	0 (0.0%)	2 (1.9%)	12 (11.1%)	15 (13.9%)	
Controls	3 (2.8%)	24 (22.2%)	6 (5.6%)	25 (23.1%)	

Table 2: Association of Decayed, Missing and Filled Teeth With The Stages of Chronic Kidney Disease

Stage of kidney disease	Decayed, Missed, Filled Teeth (DMFT) Index		P VALUE
	HIGH SCORE	LOW SCORE	
STAGE 3	10 (9.3%)	0 (0.0%)	≤0.001
STAGE 4	10 (9.3%)	1 (0.9%)	
STAGE 5	29 (26.9%)	0 (0.0%)	
CONTROLS	37 (34.3%)	21 (19.4%)	

Table 3: Difference in the Score of Decayed, Missing and Filled Teeth, Community Periodontal Index for Treatment Needs (CPITN) and Decayed Missing Filled (DMFT) Index

Parameters of oral and periodontal health	Stage of kidney disease	N	Mean Rank	Chi square	df	P value	Post hoc tests	
							Sample 1- sample 2	P value
Decayed teeth	STAGE 3	10	68.05	30.246	3	≤0.001	Controls- stage 3	0.042
	STAGE 4	11	77.14				Controls- stage 5	≤0.001
	STAGE 5	29	71.52				Controls- stage 4	0.001
	Controls	58	39.36					
Missing teeth	STAGE 3	10	64.00	35.137	3	≤0.001	Controls- stage 5	≤0.001
	STAGE 4	11	77.86				Controls- stage 4	0.001
	STAGE 5	29	74.34					
	Controls	58	38.51					
Decayed Missing Filled teeth (DMFT) index score	STAGE 3	10	68.85	44.340	3	≤0.001	Controls- stage 3	0.013
	STAGE 4	11	81.27				Controls- stage 5	≤0.001
	STAGE 5	29	76.21				Controls- stage 4	≤0.001
	Controls	58	36.09					
Filled teeth	STAGE 3	10	48.25	2.929	3	0.403	The overall test does not show significant difference across samples	
	STAGE 4	11	46.82					
	STAGE 5	29	53.90					
	Controls	58	57.34					
Community periodontal index for treatment needs (CPITN) score	STAGE 3	10	44.45	7.061	3	0.070	The overall test does not show significant difference across samples	
	STAGE 4	11	66.00					
	STAGE 5	29	63.17					
	Controls	58	49.72					

Table 2 shows a statistically significant association of general oral health as determined by DMFT index with stage of chronic kidney disease and healthy controls. It was seen that among the stages of kidney disease, patients with stage 5 had the greatest percentage of high DMFT score. This was also seen among the controls where more individuals had a high DMFT score in comparison to low score as shown in table 2.

Table 3 shows a statistically significant difference in the scores of decayed teeth, missing teeth and the decayed missing and filled teeth (DMFT) index with the highest mean rank score of all three being the highest for stage 4 patients. The highest mean rank score of the Community periodontal index for treatment needs (CPITN) was also for stage 4 patients.

It was also seen that the scores of decayed teeth and decayed missing filled index (DMFT) were statistically significantly different among the controls and stage 3, 5 and 4 while for missing

teeth score, it was seen that the difference was significant between controls and stage 4 and 5 as shown in table 3.

**DISCUSSION**

Chronic Kidney Disease (CKD) is defined as abnormalities in the function and structure of the kidneys that last for three months or longer. It is divided into five stages depends on the amount of albuminuria and the decline in glomerular filtration rate, which can progress to end-stage renal disease (ESRD)<sup>9</sup>. The National Kidney Foundation states that acceptable values of GFR vary from 90 to 120 ml/min/m<sup>2</sup>. Long-term hyperglycemia and high blood pressure are the principal factors of CKD, which have been frequently linked with decreased eGFR, resulting in stage three (eGFR 30-44 ml/min/m<sup>2</sup>) as well as stage four (eGFR 15-29 ml/min/m<sup>2</sup>) renal dysfunction. With such an eGRF of less than 15 ml/min/m<sup>2</sup>, ESRD is the 5th and also most chronic stage, worsening the morbidity and mortality rates in the population<sup>10</sup>. Dialysis and kidney

transplantation are interventions for people with end-stage renal disease (ESRD)<sup>11</sup>. Patients on hemodialysis overlook their dental hygiene for a variety of reasons, including the stress they seem to be in and the length of their treatment program. As a result, greater periodontal damage is anticipated in these patients, especially when taking into account the various medications and nutritional supplements they have been taking, like erythropoietin as well as cholecalciferol. While immunosuppressive medicines (cyclosporine & tacrolimus) are being used to avoid organ rejection in kidney transplantation patients, they are very well known for causing gingival overgrowth, that is still a problem for the dental community<sup>12</sup>. End-stage renal dysfunction is linked to a variety of clinical symptoms, including hyposalivation, decreased immunity and wound repair, alveolar bone degradation due to kidney osteodystrophy, and a general condition of dysfunction, all of which can be ascribed to poor dental hygiene<sup>13</sup>.

Alteration in salivary composition, including excessive concentrations of urea, potassium, and phosphate and significantly lowered levels of calcium, decreased salivary flow, elevated salivary pH, which appears to be much more alkaline, steadily increasing salivary buffering capacity, and increase dental calculus formation have all been found in CKD patients<sup>14</sup>. According to Davidovich et al. the patients on dialysis had more gingivitis and bleeding<sup>15</sup>. In previous studies, Tollefsen et al. found reduced gingival index values. The immune response may be suppressed, resulting in a non-significant alteration in gingival index. As per Tollefsen and Johansen, blood lymphocytes of geriatric individuals responded less efficiently to dental plaque treatment in laboratory circumstances<sup>16</sup>. In a survey of four renal failure categories, Davidovich et al. found that poor dental hygiene has been linked to the advancement of periodontal disease in individuals with chronic kidney failure<sup>15</sup>. Because 50 % (n = 15) of dialysis patients brushed their teeth once each day, the findings of a study done by Tawfig A, Jamal B support the notion that dental hygiene does have an influence on the periodontal status of Patients with chronic kidney disease<sup>17</sup>. Moreover, the elevated plaque levels of patients having dialysis suggest that they are neglectful of their dental hygiene<sup>18</sup>.

Dialysis patients have a higher incidence and severity of periodontal disease than pre-dialysis, renal transplantation, and physiologically healthy controls, according to literature<sup>17</sup>. It's possible that significant periodontal degradation in Patients with chronic kidney disease has propelled their kidney dysfunction to a severe level as well. The advancement of periodontal disease in such patients may have been impacted by the systemic illness. Chronic renal failure has been shown to have a major impact on the incidence and severity of periodontal disease<sup>18</sup>. In comparison to healthy controls, our study found a statistically significant link between periodontal health and kidney disease stage. Bleeding gums were the most common amongst the stages of renal disease, with pocket depths of 4-5mm being the most common in stage 4 and 5 individuals. Moreover, the most common periodontal issue in disease-free controls was a pocket depth of 4 to 5mm.

However, there is no clarity on the existence of dental caries. By comparing adult Chronic kidney disease patients with healthy individuals, several researchers found no change in the number of decayed, missing, or filled teeth (DMFT)<sup>19</sup>. Many have already discovered that case groups had a greater DMFT index<sup>20</sup>. CKD patients on dialysis have been found to have lower dental caries indices and greater DMFT levels. Patients having CKD have also been shown to have a higher plaque index (PI)<sup>21</sup>. According to Menezes CR<sup>22</sup> there were no variations in the overall DMFT index among groups. In the studies, similar<sup>19</sup> low<sup>23</sup> and high<sup>24</sup> DMFT indices among case and control groups have indeed been described. Numerous elements, including the period of kidney impairment, can impact such difference, as stated above. In one investigation, there was no link between both the DMFT and the length of dialysis<sup>22</sup>. Another essential issue to consideration is the age of the participants in earlier studies versus their research, as children and teenagers had the lowest DMFT index<sup>22</sup>. A strong

association has been found in the literature in between length of dialysis, the DMFT index and its constituents, and plaque index<sup>25</sup>. Our analysis reported a statistically significant link between general oral health as measured by the DMFT index and the stage of chronic renal disease in both patients and healthy controls. Patients with stage 5 renal illness showed the highest percentage of high DMFT scores of all the stages studied. This was also observed in the controls, where people with a high DMFT score outnumbered those with a low score.

**Limitation:** The study does not involve stage 1 and 2 patients because the only patients of chronic kidney disease admitted to the hospital were of stage 3,4 and 5. A multicenter study could have helped overcome this problem.

## CONCLUSION

There was a significant association between periodontal health and stage of kidney disease and healthy controls. Among the stages of kidney disease bleeding gums were the most common in stage 3 while pocket depths of 4-5mm were the highest in stage 4 and 5 patients. Pocket depth of 4 to 5mm was the most prevalent periodontal problem in disease free controls. There was a significant association of general oral health as determined by DMFT index with stage of chronic kidney disease and healthy controls. Among the stages of kidney disease, patients with stage 5 had the greatest percentage of high DMFT score. In the controls more individuals had a high DMFT score in comparison to low score. A significant difference in the scores of decayed teeth, missing teeth and the decayed missing and filled teeth (DMFT) index with the highest mean rank score of all three for stage 4 patients. The scores of decayed teeth and decayed missing filled index (DMFT) were significantly different among the controls and stage 3, 5 and 4 while for missing teeth score, the difference was significant between controls and stage 4 and 5.

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