

# Establishing an Association between Renal Failure and Periodontal Health: A Cross Sectional Study

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## ABSTRACT

Periodontal infections can act as focus of infection, aggravating the immunocompromised state of End Stage Renal Disease patients (ESRD).

**Aim:** Evaluation of the periodontal health status of ESRD patients undergoing haemodialysis and establishing the underlying association between renal failure and periodontal disease.

**Material and Methods:** Eighty control and test subjects were included in the study, after matching age and sex. Creatinine and GFR were measured in each patient. Oral hygiene index-Simplified (OHI-S), Gingival Index (GI), Pocket Depth (PD) and Clinical Attachment Level (CAL) were recorded as periodontal parameters to assess the correlation between the subjects of the two groups. Further, the test group was divided into three sub-groups, on basis of duration, as less than 6 months, from 6 months to one year and more than one year.

**Statistical Analysis:** Student's t – test and ANOVA were used to analyze the inter-group and intragroup comparisons.

**Results:** Statistical significant difference was observed for all periodontal parameters between the test and control group. However, difference amongst periodontal parameters on basis of duration of haemodialysis was seen between the subgroups of test subjects, it was not found to be statistically significant.

**Conclusion:** Severity of periodontal diseases in ESRD patients undergoing haemodialysis majorly affected due to debilitating condition of the subjects. Dialysis vintage has only a small role to play in worsening of the condition. Further research is needed to potentiate the establishment of two-way relationship between renal disease and periodontal condition.

**Key words:** Glomerular filtration rate, Periodontitis, Clinical attachment loss, Probing depth

## INTRODUCTION

Slow progression to End Stage Renal Disease (ESRD) has led to underdiagnosis and under treatment of patients, leading to irreversible nephron damage. Chronic loss of renal function alters the normal homeostatic mechanism of electrolyte balance. Artificial dialysis is a means by which excessive toxic and nitrogenous waste products are excreted from the blood, to prolong the life span. It is challenging for these individuals to attain an adequate health status [1,2]. Glomerular filtration rate is considered as a gold standard for assessing renal function. End stage renal failure can be associated with various clinical findings like hyposalivation, impaired immunity and wound healing, alveolar bone destruction due to renal osteodystrophy and a general state of disability, attributed to unacceptable oral hygiene practices [3,4]. Risk factors like diabetes, hypertension, SLE are common predisposing factors to periodontal disease and end stage renal condition, having biologically plausible common risk mediators involved infection and inflammation. Various studies reflect the positive association between debilitating condition of end stage renal disease and periodontal disease progression [5-7]. However, few authors like Castillo et al found no correlation between ESRD and periodontitis [8]. Therefore, a cross-sectional study was designed to evaluate the clinical periodontal status of ESRD patients undergoing haemodialysis, for exploring the underlying association between renal failure and periodontal disease.

## MATERIAL AND METHODS

### Study Population

A total of 80 subjects were included in the present study. Subjects were divided into two groups, test and control. Test group consisted of 40 (males = 13, females = 27; mean age = 38.03 ± 7.41) end

stage renal disease patients (ESRD), who were undergoing haemodialysis in Safdarjung Hospital, New Delhi, India. According to outcome quality of kidney disease, ESRD subjects were selected on basis of glomerular filtration rate of <15 ml/min/1.73m<sup>2</sup>. After matching age and sex, 40 control subjects (male = 14, female = 26; mean age = 40.55 ± 5.45) with normal GFR values, who reported for professional oral care to the dental OPD of ITS – Centre for Dental Sciences and Research, Muradnagar, Uttar Pradesh, India, were recruited in the study. Informed consents were obtained from all the subjects. Exclusion criteria were history of periodontal therapy or the use of antibiotics during the last 3 months prior to examination, pregnancy or lactation.

To determine the effect of duration of dialysis on the periodontal health status of subjects in test group, it was further divided into three Groups: 1) subjects receiving dialysis for less than 6 months; 2) subjects on dialysis for 6 months to 1 year; 3) subjects on dialysis for more than 1 year.

### Renal Parameters

Serum GFR and creatinine values were calculated from each subject in the study, by withdrawing 10 ml of blood through venipuncture from antecubital fossa. GFR was calculated using MDRD equation:  $186 \times (\text{Creat}/88.4) - 1.154 \times (\text{Age}) - 0.203 \times (0.742, \text{ if female}) \times (1.210, \text{ if black})$ .

### Periodontal Parameters

Experimental design was explained to all the participants. Oral hygiene index-simplified by Greene and Vermillion (OHI-S) [9] and Gingival Index which was introduced by Loe and Silness (GI) [10] were assessed. Full mouth periodontal charting for Probing Depth (PD) and Clinical Attachment Level (CAL) at six sites on each tooth

were done with a periodontal probe rounded to the nearest whole millimetre reading. Periodontal investigations were carried out by two trained dentists under sufficient illumination. Elaborated dental and medical history, oral hygiene practice, personal habits and educational level were also recorded by taking detailed interviews of the subjects.

## STATISTICAL ANALYSIS

All statistical analysis was done using SPSS statistical software package. Student's t-test was used to analyze the intergroup difference between the means, by regarding all the parameters. One way analysis of variance (ANOVA) was used to determine the significance between subgroups of the test group. All analysis were done at 0.05 level of significance.

## RESULT

Mean and standard deviation (SD) values for Creatinine, GFR, OHI-S, GI, PD and CAL have been shown in [Table/Fig-1]. Statistically significant differences were observed for all the parameters in the intergroup comparison. (Creatinine:  $t = -14.51$ ,  $p = 0.00$ ; GFR:  $t = 20.91$ ,  $p = 0.00$ ; OHI-S:  $t = -9.47$ ,  $p = 0.00$ ; GI:  $t = -7.91$ ,  $p = 0.00$ ; PD:  $t = -6.96$ ,  $p = 0.00$ ; CAL:  $t = -8.19$ ,  $p = 0.00$ ).

Mean and standard deviation for age, OHI-S, GI, PD, CAL on basis of duration of haemodialysis have been shown in [Table/Fig-2]. Although difference existed between the values of the subgroups, it was not found to be statistically significant. (Age:  $p = 0.80$ ; OHI-S:  $p = 0.81$ ; GI:  $p = 0.23$ ; PD:  $p = 0.21$ ; CAL:  $p = 0.16$ ) This meant that with increased duration of haemodialysis, oral hygiene status of patients worsen due to their medically compromised state, attributing to periodontal destruction.

Subjects in our study represented a sample of Indian population, with values of OHI-S and GI for the control group ( $1.69 \pm 0.55$  and  $1.17 \pm 0.40$  respectively), indicating a fair hygiene status and gingiva health near to normal, amongst subjects who were intended to have routine personal oral practices. However, Hygiene Status and Gingival Index ( $3.59 \pm 1.15$  and  $1.91 \pm 0.44$  respectively) for the test group were poor, owing to the debilitating condition of patients, which restricted the mechanical plaque control and worsened the oral hygiene.

Parameters	control	test	t - value	p - value
creatinine	$0.94 \pm 0.17$	$13.93 \pm 5.66$	-14.51	0.00
GFR	$88.88 \pm 25.23$	$4.99 \pm 2.58$	20.91	0.00
OHI-S	$1.69 \pm 0.55$	$3.59 \pm 1.15$	-9.47	0.00
GI	$1.17 \pm 0.40$	$1.91 \pm 0.44$	-7.91	0.00
PD	$2.12 \pm 0.41$	$2.82 \pm 0.49$	-6.96	0.00
CAL	$2.43 \pm 0.33$	$3.40 \pm 0.68$	-8.19	0.00

[Table/Fig-1]: Mean and standard deviation (SD) values for control and test group.

	n	age	OHI-S	GI	PD	CAL
0- 6 months	12	$39 \pm 8.31$	$3.49 \pm 1.13$	$1.73 \pm 0.48$	$2.63 \pm 0.40$	$3.14 \pm 0.79$
6months - 1year	13	$37 \pm 7.61$	$3.76 \pm 1.16$	$2.02 \pm 0.37$	$2.95 \pm 0.51$	$3.65 \pm 0.53$
> 1 year	15	$38.13 \pm 6.87$	$3.53 \pm 1.13$	$1.97 \pm 0.46$	$2.88 \pm 0.52$	$3.40 \pm 0.65$

[Table/Fig-2]: Mean and standard deviation (on basis of duration of haemodialysis)

## DISCUSSION

Every ESRD patient receiving haemodialysis is suitable for renal transplant, as it is the best treatment option for restoring patient's normal lifestyle. But, to find a kidney of choice for transplantation may have a waiting period, in which patients remain in an immunocompromised state. Their oral hygiene is neglected, as it a secondary concern for the patient. As these patients are in a

prolonged state of chronic kidney failure, it results in uremic syndrome which is associated with immune dysfunction, including defects in lymphocyte and monocyte functions [11]. The oral infections can act as a focal infection during this period and they therefore require adequate attention [12]. Page revealed that periodontal disease acts as a reservoir for gram negative bacteria and bacterial inflammatory mediators like TNF-  $\alpha$ , PGE 2, IL- 1 $\beta$ , which affects the systemic status of a being [13]. The response to periodontal pathogens triggers tissue destructive immune-inflammatory response this leads to simultaneous creation of secondary systemic inflammatory burden and systemic dissemination of periodontal pathogens and their locally produced products like lipopolysacchride, cytokines, etc [14,15]. On the other side, Yamalik et al., demonstrated information obtained by 22 haemodialysis centres in 12 countries; 50% of them did not suggest that periodontal disease was the source of infection [16].

However, in accordance to our study, Kitsou et al., [17] found that a majority of haemodialysis patients were not able to brush their teeth often. Galili et al., [18] also revealed that patients undergoing haemodialysis had significantly lower moods for oral care and were less intense for oral hygiene than Controls. Furthermore, Tollfsen et al., [19] also found significantly more plaque and gingival indices in haemodialysis patients than in the transplanted ones. Increased levels of plaque have also been reported for haemodialysis populations in various countries, including Brazil, Canada, Spain and the United States [3,8,20-22].

Some authors have reported that the prevalence of periodontal disease was also higher in patients on haemodialysis but these reports were poorly substantiated, as they either lacked a control group or included other diseases such as severe gingivitis under the title of periodontal disease [21, 23]. Increased prevalence and severity of periodontitis was also found, as a measure of increased pocket depth and attachment loss in a study which was done on ESRD patients on HD maintenance therapy, who received periodontal examinations in the Third National Health and Nutrition Survey (NHANES III) [24]. Chuang et al., [25] reported increased periodontal disease, as was measured by the Community Periodontal Index in adults receiving haemodialysis. Moreover, Duran et al., [26] found increased amount of periodontitis in ESRD patients on haemodialysis in Turkey. However, in contrast to our findings, Marakoglu et al., [27] found no increase in periodontitis in ESRD patients as compared to a group of age and sex matched control subjects. Castillo et al., [8] assessed the periodontal status of ESRD patients receiving HD and found no increase in periodontal indices as compared to case-matched controls. Queiroz et al., [28] opined that most patients undergoing dialysis presented precarious oral hygiene, periodontal inflammation, and bone alterations, irrespective of the duration of dialysis or bone metabolism.

An increase in OHI-S, PD and CAL values was observed, as a trend with increasing duration of patients undergoing dialysis, although it was statistically insignificant. This observation affirmed that the negligence of oral hygiene led to long standing plaque accumulation and henceforth, to periodontal destruction in chronic haemodialysis state. As support to our finding, no correlation between increased gingival inflammation and occurrence of periodontitis was reported by various other authors [21,27,29]. Some recent studies suggested that effective periodontal therapy may decrease systemic inflammation and endothelial dysfunction. Therefore, periodontitis in renal haemodialysis populations may be a reversible source of systemic inflammation that can be managed through effective periodontal therapy [30].

Our study its one of is kind conducted in the Indian population, representing the mental state of patients under debilitating condition, supporting the existence of interplay between renal condition and oral health and potentiating the existence of relationship between ESRD patients receiving haemodialysis and their periodontal

condition, with leading cause being ignorance of oral hygiene measures, poor plaque control regime, lack of motivation and neglect towards incorporation of professional oral care for these patients. Regular dental check ups, periodic reinforcement of oral hygiene measures and instructions and maintenance of recall visits can help in improving the oral status of these patients.

## CONCLUSION

Findings of this study support the hypothesis that the conditions of chronic renal failure and periodontitis are interlinked. ESRD patients receiving haemodialysis were observed to have poor plaque, gingival and periodontal status as compared to Controls. However, duration vintage of dialysis has a limited role to play in the severity of periodontitis.

Further, studies with larger sample sizes can be carried out in a cross sectional manner. Eradication of the confounding variables such as diabetes, mellitus, smoking, degree and longer duration of medical management of renal failure complications, may help in achieving more reliable relationship in periodontal condition of ESRD patients receiving haemodialysis.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Feb 22, 2013**  
Date of Peer Review: **May 15, 2013**  
Date of Acceptance: **Aug 08, 2013**  
Date of Publishing: **Oct 05, 2013**