ORIGINAL RESEARCH

The Dental and Periodontal Status of Patients with End-Stage Renal Disease (ESRD) Undergoing Haemodialysis (HD)

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ABSTRACT

Introduction: Patients with ESRD undergoing HD are affected by many systemic diseases due to their lack of ability to control water and electrolyte balance and filtrate waste products. Obviously, there would be some manifestations in the oral cavity. **Purpose:** This study was carried out to evaluate the dental and periodontal status of patients with ESRD, undergoing HD. **Subjects and methods:** Fifty one HD patients attending the Department of Nephrology of Buraidah Central Hospital (BCH) and Department of Nephrology of King Fahad Specialist Hospital (KFSH) for receiving their HD therapy were included in this study. A detailed medical and dental history was also collected from all subjects. **Results:** The results revealed that all patients had periodontal disease. Debris status was high all age group patients. It was also revealed that the older hemodialysis patients, the more severe periodontal disease. **Conclusion:** It seems that patients did not pay much attention to their oral hygiene; therefore the need for appropriate instructions and education in this regard is evident.

KEYWORDS:. HD , DMF , Time On Dialysis, Debris Status, Gingival Condition, Pocket Depth, Attachment Loss

INTRODUCTION

The kidneys perform four essential functions: excretion of the end products of metabolism, particularly urea, regulation of blood volume and electrolyte concentration, regulation of erythrocyte production in the bone marrow through the secretion of erythropoietin and participation in calcium homeostasis through hydroxylation of vitamin D3 into active or inactive metabolites.[1] Therefore, any pathologic process that results in decreased renal function would be expected to have serious, pleiotrophic effects. Renal function is assessed, in part, by measurement of the glomerular filtration rate.[2]

ESRD is the progressive and irreversible decline in the number of functioning nephrons. Once the damage is past the point of improvement, patients enter the final stage of renal disease. In this case, dialysis treatment and kidney transplantation are considered critical medical procedures.[3,4]

Improvement in dialysis and modalities for treating patients with ESRD are extending the life expectancy of the affected patient population.[5,6] Oral and dental examinations of patients, who are candidates for receiving a renal transplant, are required to eliminate potential infections.[6,7] Patients under dialysis are more susceptible to infection, because of general debilitation and depression of the immunologic response.[8] Furthermore, in patients using immunosuppressant's for receiving a renal transplant, persisting oral infections can have a severe course. They can even be the cause of

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rejection of the transplanted kidney. Thus, it is of utmost importance to determine and treat also periodontal diseases except for other oral and dental illnesses.[9] Several studies report that gingivitis and periodontitis are common findings in HD patients.[10,11]

Periodontal diseases are initially bacteria driven causing chronic inflammatory condition which leads to pocketing formation as well as the destruction of deep collagenous structures of the periodontium and alveolar bone; it also causes excessive mobility of the teeth resulting in their premature loss.[12,13] Periodontal diseases seem to affect the general health condition causing systemic low-grade inflammation, development and progression of atherosclerosis, diabetes mellitus, pulmonary diseases, osteoporosis and renal insufficiency.[12,13] The studies of periodontal status in adults with chronic kidney disease performed in the past 10 years are scarce and concerned exclusively patients on maintenance HD.[10,14] interestingly; only half of them indicate an increased prevalence and/or severity of periodontitis in HD subjects.[10,15]

Moreover, the factors predisposing to periodontal disease and accelerating its progression are widespread in ESRD. Such factors include hyposalivation and xerostomia, impaired immunity and wound healing, alveolar bone destruction caused by renal osteodystrophy, bleeding diathesis, diabetes mellitus, malnutrition and a general incapacity impairing oral hygiene.[16,17]

Chronic renal disease has well-documented effects on oral tissues including xerostomia, delayed tooth eruption, calcifications leading to obliteration of pulp chamber and canals, enamel hypoplasia, decreased caries rates and altered salivary pH levels.[18,19]

Patients with ESRD undergoing HD are affected by many systemic diseases due to their lack of ability to control water and electrolyte balance and filtrate waste products. Consequently, the oral cavity especially the gingival will be affected. Like the patients with other systemic diseases, in patients with ESRD frequent recall examinations as preventive measures should be emphasized in order to minimize the need for extensive dental treatment. Close consultation between the dentist and the physician is essential for safe dental management of these patients. Both HD and renal transplant patients must be protected against infection. This is achieved through early, dental treatment.[20]

This study was done to evaluate the dental and periodontal condition of patients with ESRD, undergoing HD therapy.

MATERIALS AND METHODS

Participants

Fifty-one HD (30 male, 21 female, mean age: 43 ± 17 years) patients attending the Department of Nephrology of BCH and KFSH for receiving their HD therapy, were included in this study. All participants gave informed consent to participate in this study. Informed consent was obtained from each patient prior to enrolment in this study.

Clinical examination and indices

Prior to clinical examination, a medical history was taken from each subject. Dental health status was determined by visual examination using a probe and dental mirror. Decayed, Missing or Filled Teeth (DMFT) were documented and also the dental health status was calculated using the DMFT index.[21] Periodontal indices were performed using a dental mirror, explorer and a periodontal probe with William's markings. For assessing the oral hygiene the Simplified Debris (plaque) Index DI-S as described by Greene-Vermillion was used.[22] Nominal scale for evaluation of DI-S was divided into : Excellent – 0; Good - 0.1-0.6; Fair – 0.7-1.8; Poor – 1.9-3.0. Gingival condition was evaluated using the gingival index (GI).[23]

A blunt instrument, such as a periodontal pocket probe, was used to assess the bleeding potential of the tissues in this index. The formula to count the gingival index is:

Gingival value /1 tooth= Sum of total value per teeth / 4

Gingival index per person= Sum of total gum value per teeth / Total teeth examined

The gingivitis severity level was divided into four : (1) normal gingival with gingival index of 0 , (2) mild gingivitis with gingival index 0.1-1.0 ,(3) moderate gingivitis with gingival index 1.1-2(4) sever gingivitis with gingival index of 2.1-3 (Table 1) .

Score	Gingival Condition	Explanation
0	normal	Pink, stippling appearance gummy tapered interdental papilla
1	Mild gingivitis	Little discoloration and edema , no bleeding when probing
2	Moderate gingivitis	Reddish gingival , edema and bleeding when probing
3	Sever gingivitis	Dark red appearance , edema , ulceration, tend to bleed spontaneously

Table.1 presents the gingivitis severity

The periodontal condition was examined using the probing pocket depth (PPD) to measure the distance between the bottom of the pocket and the margin of the gingiva from six sites of each tooth (mesiovestibule, midvestibule, distovestibule, distolingual, midlingual and mesiolingual).

Loss of attachment was assessed on with the probe used for measuring probing depth. Similarly, loss of attachment of 1 mm or less was described as 1 mm, that exceeding 1mm but less than 2 was recorded as 2 mm and so forth.When the CEJ was located apical to the gingival margin, the loss of attachment was the difference between the previously recorded probing depth (A) and the distance (B) from the gingival margin to the CEJ. A − B = loss of attachment.

When the marginal gingiva was recorded and CEJ exposed, the sum of attachment equaled the PPD and the distance from the gingival margin to the CEJ. A + B = loss of attachment.

STATISTICAL ANALYSIS

The study results were expressed by mean values and standard deviations (SD), P-values less than 0.05 were considered statistically significant. The data were analyzed using an SPSS (version17) statistical program package.

RESULT

1-The relation between age group and DMF score: Table 2 showing the mean DMF for the study age groups, the DMF were 6.18 , 8.63, 8.13, 11.67, 16.50 and 9.04 for the age groups 20 – 30 y, 31-40y, 41-, 51-60 y and more than 60 y old respectively. With no statistically significant difference between the age group at P≤0.05.

Age Group	N (51)	Std. Deviation±mean	F(P)
20- 30y	11	6.18 ± 5.095	1.905
31-40 y	11	8.63 ± 9.542	(0.126)
41- 50y	16	8.13 ± 5.667	
51- 60y	9	11.67 ± 9.220	
More than 60 y	4	16.50 ± 3.697	

*F: for one way ANOVA test *statistically significant at p <0.05

Table.2 presents the relation between age group and DMF score

2-The relation between age group and gingival condition: There is with no statistically significant difference between Age groups at P≤0.05. While the majority of gingival conditions were detected in mild condition was 31-40 years old group (54.5%), in moderate condition was 20 - 30 years old group (54.5%) and in severe condition was more than 60 years old group (50%) as shown in (Table 3).

			Age_groups					
			20 - 30 y	31-40 y	41 - 50 y	51 - 60 y	More than 60 y	Total
Gingival condition	**Mild**	Count	3	6	6	3	0	18
		% within Age_groups	27.3 %	54.5 %	37.5 %	33.3 %	.0%	35.3 %
	Moderate	Count	6	4	5	6	2	23
		% within Age_groups	54.5 %	36.4 %	31.3 %	66.7 %	50.0 %	45.1 %
	Severe	Count	2	1	5	0	2	10
		% within Age_groups	18.2 %	9.1%	31.3 %	.0%	50.0 %	19.6 %
	Mcp		0.257					

*Mcp = p value for monte Carlo chi square test

Table.3 showing the relation between age group and gingival condition

3-The relation between age group and local factors: The table 4 demonstrating the relation between age group and DI-S, there is no statically significant difference between the relation of age group and DI-S at P≤ 0.05. While the majority of debris status were situated in poor condition for the entire age groups.

Table.4 showing the relation between age group and local factors

			Age_ groups					Total
			20 - 30 y	31-40 y	41-50 y	51 - 60 y	More than 60 y	
Debris status	**Good**	Count	2	2	1	1	0	6
		% within Age_groups	18.2%	18.2%	6.3%	11.1 %	.0%	11.8%
	Fair	Count	2	4	3	1	0	10
		% within Age_groups	18.2%	36.4%	18.8%	11.1 %	.0%	19.6%
	Poor	Count	7	5	12	7	4	35
		% within Age_groups	63.6%	45.5%	75.0%	77.8 %	100.0 %	68.6%
Mcp			0.672					

*Mcp = p value for monte Carlo chi square test
* statistically significant at p<0.05

4-The relation between age group and Pocket depth: Table 5 showing the relation between age group and Pocket depth which demonstrated no statically significant difference between the relation of age group and Pocket measurement at P≤ 0.05. Although the deepest pocket depth was among 20-30 y old (2.281±1.7747 mm).

Age group	N(51)	Mean ± Std. Deviation	F(P)
20-30	11	2.281±1.7747	0.247 (0.910)
31-40	11	1.963±.8924	
41-50	16	2.050±.9770	
51-60	9	1.791±1.320	
More than 60 y	4	1.800±.4000	

*F: for one way ANOVA test, *statistically significant at p <0.05
Table.5 presents the relation between age group and Pocket depth

5-The relation between age group and attachment loss measurement: Table 6 revealed the relation between age group and attachment loss measurement (ATL) and proved that there is statically significant difference between age group and attachment loss measurement by Turkey HST POST HOC test at P≤ 0.05. There was statically significant difference between 20- 30 y group, 31-40 y & 41-50 y old groups and more than 60 years old group.

Table.6 presents the relation between age group and loss measurement

Age group	N(51)	Std. Deviation ± mean	F(P)
20- 30y	11	1.309 ± 2.523	3.566 (0.013)
31-40 y	11	1.66 ± 1.513	
41- 50y	16	2.563 ± 2.249	
51- 60y	9	3.347 ± 3.377	
More than 60 y	4	6.823 ± 5.256	

*F: for one way ANOVA test , *statistically significant at p <0.05

6-The relation between Time on dialysis groups and DMFT score: Table 7 showing the relation between time on dialysis groups and DMFT score with no statistically significant difference between times on dialysis groups at P≤0.05. The highest mean was observed in less than 1 year group (14.13).

Time on dialysis	N (34)	Std. Deviation±mean	F(P)
Less than 1 year	8	14.13± 10.535	1.925 (.147)
1 to 3 years	18	8.61 ± 5.359	
4 to 5 years	3	3.67± 2.887	
more than 5 years	5	7.80 ± 8.408	

*F: for one way ANOVA test, *statistically significant at p <0.05
Table.7 presents the time on dialysis groups and DMFT score

7-The relation between Time on dialysis group and gingival condition: Table 8 showing the relation between time on dialysis groups and GI With no statistically significant difference between times on dialysis groups at P≤0.05. While the majority of gingival condition were detected in mild condition is 4 to 5 years group (66.7%), in moderate condition is less than 1 year (62.5%) and in severe condition is more than 5 years (60.0%)

8-The relation between time on dialysis group and local factors: Table 9 showing the relation between time on dialysis groups and DI-S with no statistically significant difference between times on dialysis groups at P≤0.05. While the majority of debris status were situated in poor condition for the all time on dialysis group.

			Time on dialysis				Total
			Less than 1 year	1 to 3 years	4 to 5 years	more than 5 years	
Ging_ condition	**Mild**	Count	1	9	2	2	14
		% within Time on dialysis	12.5%	50.0%	66.7%	40.0%	41.2 %
	Moderate	Count	5	7	1	0	13
		% within Time on dialysis	62.5%	38.9%	33.3%	.0%	38.2 %
	Severe	Count	2	2	0	3	7
		% within Time on dialysis	25.0%	11.1%	.0%	60.0%	20.6 %
Mcp			.079				

*Mcp = p value for monte Carlo chi square test, * statistically significant at p<0.05(Table 7)

Table.8 presents the time on dialysis groups and gingival condition

			Time on dialysis				Total
			Less than 1 year	1 to 3 years	4 to 5 years	more than 5 years	
Debris_ status	**Good**	Count	1	1	1	2	5
		% within Time on dialysis	12.5%	5.6%	33.3%	40.0%	14.7 %
	Fair	Count	1	4	0	0	5
		% within Time on dialysis	12.5%	22.2%	.0%	.0%	14.7 %
	Poor	Count	6	13	2	3	24
		% within Time on dialysis	75.0%	72.2%	66.7%	60.0%	70.6 %
Mcp			0.438				

*Mcp = p value for monte Carlo chi square test, * statistically significant at p<0.05(Table 7)

Table.9 presents the time on dialysis groups and local factors

9-The relation between Time on dialysis group and Pocket depth: Table 10 showing the relation between Time on dialysis group and Pocket with no statically significant difference between the relation of Time on dialysis group and pocket measurement at P≤ 0.05. Although the deepest pocket depth detected was 2.53 mm among (1 to 3 years and 4 to 5 years group) respectively.

10-The relation between Time on dialysis group and attachment loss: Table 11 showing the relation between Time on dialysis group and ATL with no statically significant difference between the relation of Time on dialysis group and ATL measurement at P≤ 0.05. Although the highest mean were found in more than 5 years group (4.62 mm).

Table.10 presents the time on dialysis groups and Pocket depth

*F: for one way ANOVA test *statistically significant at p <0.05

Time on dialysis	N (34)	Std. Deviation±mean	F(P)
Less than 1 year	8	1.6500± .68034	1.010 (.402)
1 to 3 years	18	2.5289± 1.47336	
4 to 5 years	3	2.5333± .92376	
more than 5 years	5	2.0000±1.22474	

Table.11 presents the time on dialysis groups and attachment loss

Time on dialysis	N (34)	Std. Deviation±mean	F(P)
Less than 1 year	8	2.6625± 2.27467	1.615 (.207)
1 to 3 years	18	2.7989± 2.47680	
4 to 5 years	3	.0000± .00000	
more than 5 years	5	4.6200±5.21028	

*F: for one way ANOVA test *statistically significant at p <0.05

DISCUSSION

Many systemic diseases and conditions such as CRF can have direct oral manifestations or cause an indirect effect by modifying the host inflammatory or immune response and by changing the host–parasite interaction balance. This is crucial in the pathogenesis of the two most prevalent oral infections – caries and periodontal diseases.[24] Previous authors have reported that the oral health of HD patients is worse than that of the general population in terms of caries, gingivitis, periodontitis, plaque buildup and general oral health status.[11-25] Fifty one HD patients was involved in this study 30 male, 21 female with mean age: 43 ± 17 years, according to this study, patients have different types of periodontal diseases, regarding debris status there is no statically significant difference between the relation of age group and DI-S at P≤ 0.05. While the majority of debris status were situated in poor condition for the entire age groups.

This increase in the plaque and calculus deposition in the HD patients could be attributed to poor oral

hygiene; similar observations have also been reported elsewhere(Epstein et al, 1980; Eigner et al, 1986; Levy, 1988; Naugle et al, 1998; Gavalda et al, 1999; Klassen and Krasko, 2002; Al Wahadni and Al Omari, 2003[11-15, 16] Some have also suggested that an altered serum phosphorus-calcium balance might be responsible, with increased calculus deposition resulting from changes in salivary composition (Epstein et al, 1980; Eigner et al, 1986; Gavalda et al, 1999).[9,26,27]

This is in agreement with the results reported by many investigations Bots et al (2006), Marakoglu et al (2003), Yamalik et al (1991) and Tollefsen and Johansen (1985) (14-31), who support the suggestion that although uremic state causes an immunosuppressed state, the host is still able to react against a bacterial load.

As previously reported, our study also revealed a tendency toward lower prevalence of caries in the HD with increase in age group, although the difference was not statistically significant (Jaffe et al, 1986; Nunn et al, 2000).[29,30] They explained the lower prevalence of caries in HD patients with an increased salivary urea concentration, which is split to form ammonia, and may raise the pH above the critical level that causes demineralization of dental enamel (Epstein et al, 1980; Jaffe et al, 1986; Nunn et al, 2000).[26,29,30] It has been suggested that high levels of salivary urea produce an anticariogenic effect by inhibiting growth of microorganisms and neutralizing acid formed in dental plaque (Sowell, 1982).[3]

Gingival Index values of the HD patients the in relation to age groups, there is with no statistically significant difference between Age groups at $P \leq 0.05$. While the majority of gingival conditions were detected in mild condition was 31-40 years old group (54.5%), in moderate condition was 20 - 30 years old group (54.5%) and in severe condition was more than 60 years old group (50%).

This finding suggests that higher plaque levels in the HD group as well as the increased Bleeding Index might be the result of the anticoagulant medication they have to take.[10] It has been suggested that the uremic state in the HD patients may suppress inflammatory reactions so gingival inflammation would be irregular in detections in these patients. (Tollefsen and Johansen, 1985; Kerr, 2001).[4,28] An experimental gingivitis study on a group of HD patients and healthy controls (Kitsou et al, 2000)[31] showed no differences in the evolution of experimental gingivitis in both groups, indicating that uremia would not retard gingival inflammation in HD patients. Therefore, gingivitis would progress in the same way as in healthy controls and would develop only because of insufficient oral hygiene (Epstein et al, 1980; Eigner et al, 1986; Ertugrul et al, 2003).[9,26,32]

This study showed that older hemodialysis patients experienced severe periodontal diseases and there was a significant relation between severity and age. Although no statically significant difference between the relation of Time on dialysis group and pocket measurement at $P \leq 0.05$, but the deepest pocket depth detected was 2.53 mm among (1 to 3 years and 4 to 5 years group) respectively. Also attachment loss measurement revealed no statically significant difference between the relations of time on dialysis group at $P \leq 0.05$. Although the highest mean were found in more than 5 years group (4.62 mm). Tollefsen et al. reported similar results in their studies.[28]

The severe periodontal diseases in older hemodialysis patients may be due to patients undergoing HD therapy are more dependent on health centers, as they receive dialysis therapy bound to a machine for approximately 4 hours several times a week. Al Wahadni and Al Omari (2003)[11] reported that individuals on HD therapy may ignore oral hygiene and other potential problems due to spending much time in the dialysis center. Likewise Galili et al (1983)[33] stated that patients on HD therapy would be depressed due to their more severe systemic condition and thus would show insufficient compliance during dental treatments and neglect oral health care. Another concern is about the influence of some drugs these patients have to take, on their periodontal health status. Thus, it would be interesting to categorize the

dialysis patients regarding their medication in their treatment protocol and to analyze the effects of medications on periodontal health status in further studies.[7,33]

CONCLUSION

The present findings showed that ESRD patients receiving HD therapy are highly susceptible to dental and periodontal diseases due to their poor oral hygiene and awareness level. Therefore, dentists and nephrologists must take responsibility as health worker professionals that they are part of our society, need a special care, attention and education to maintain a good systemic health as well as oral health. Therefore, they should cooperate and establish an oral hygiene program which combined between education and primary care treatment early as soon as they started their HD therapy to improve their oral hygiene. However, Further studies with a larger in number of subjects and include controlled group in future studies should be applied to demonstrate more supported and reliable data.

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