DOI: 10.7860/JCDR/2013/5813.3402

Original Article

Dentistry Section

Oral Health Status in Haemodialysis Patients

LINGAM AMARA SWAPNA[1], REDDY SUDHAKARA REDDY[2], TATAPUDI RAMESH[3], REDDY LAVANYA REDDY[4], NIMMA VIJAYALAXMI[5], PARTHA KARMAKAR[6], KOPPOLU PRADEEP[7]

ABSTRACT

Objective: To assess the oral and dental manifestations in non-diabetic and diabetic uraemic patients who were undergoing haemodialysis and to estimate and compare the salivary pH in these two groups.

Material and Methods: Ninety Seven uraemic patients who were undergoing maintenance haemodialysis were included in the study. Subjective and objective findings were evaluated and recorded in a specially designed proforma. Predialytic unstimulated whole salivary pH was recorded by using pH-measuring strips. Dental health assessment consisted of DMFT and CPITN indices.

Results: A subjective oral manifestation of dysguesia was found to be more significant in non-diabetic patients ($p<0.008$). Statistically, a high significance was observed with mucosal petechiae in 31.9% patients of diabetic group .The overall DMFT score was significantly higher in diabetic group. A moderate significance was found with a CPI score of 5 ($p<0.015$). The pH of saliva was significantly higher among diabetic patients.

Conclusion: The diabetic subjects who were on haemodialysis were at a high risk for developing periodontal disease and they exhibited a potential threat for dental decay and xerostomia. A lower salivary pH and a poor glycaemic control may affect their oral health. Further research is required to clarify the combined influence of diabetic nephropathy on oral health.

Key words: Community periodontal index (CPI), Dental caries, Missing, Filled, Total score (DMFT)

INTRODUCTION

It is a well-known fact that many systemic diseases are manifested in the oral cavity, and the ideal management for treating such manifestations is treating the primary cause first and then providing local therapy if it is needed. One such systemic disease which a dentist can encounter in his practice is chronic renal failure (CRF) or end stage renal disease (ESRD).

Frerichs first described oral manifestations of uraemia more than 150 years ago [1]. Researchers estimate that up to 90% of renal patients will show oral symptoms [2,3] and more than 30 oral signs and symptoms have been reported. Some of the presenting signs were an ammonia-like taste and smell, stomatitis, gingivitis and a decreased salivary flow in severe uraemic cases [4]. Other uraemic oral manifestations which have been reported in literature include, tongue coating, mucosal inflammation, mucosal petechiae, ecchymosis, oral ulceration and enamel hypoplasia. High incidences of gingivitis and periodontitis and a low incidence of caries have been reported in uraemic patients [5-6].

Haemodialysis remains the most common therapeutic modality, which is an artificial method of removing nitrogenous and other toxic products of metabolism from the blood by using a haemodyalizing system. An exchange occurs between the patient's plasma and dialysate across a semipermeable membrane that allows uraemic toxins to diffuse out of plasma, while retaining the formed elements and protein composition of the blood. It is a life saving intervention that has reduced the mortality of this still fatal disease [7].

Patients with CRF, who undergo dialysis or renal transplants, are susceptible to a number of infections, because of the depression of the immune functions and masking of the classic signs of inflammation and infection. Lymphocyte number and function are reduced; neutrophil chemotaxis and phagocytosis are impaired [8,9]. Transient bacteraemias occur in a wide variety of dental treatments, particularly those which are associated with mucous membranes. Dental management of these patients should consist of prevention and control of bacteraemias which are of dental origin [2]. Thus, an antimicrobial prophylaxis is essential in these patients. The benefit of dialysis outweighs the risk of life-threatening uraemic complications, but this modality can lead to numerous complications which are of importance to the dentist [5], for example, an increased bleeding tendency because of anticoagulants which are used in haemodialysis [2].

Although the oral and dental changes of the individual diseased condition i.e. Diabetes Mellitus (DM) and uraemia have been examined, investigations for diabetic uraemic patients who are on haemodialysis are limited. A need arises to separate the complications of the coexisting conditions from the complications of CRF itself. The complications which are caused by CRF and those that are aggravated by other diseases such as DM.

Since the influence of coexisting medical condition, that is DM and CRF, on oral and dental health requires an updated approach, a need arises, to assess oral and dental health status of diabetic uraemic patients who undergo haemodialysis.

MATERIAL AND METHODS

This study consisted of 97 uraemic male and female patients who were under maintenance haemodialysis at Bhimavaram Hospital, who were divided into non-diabetic uraemic patients and type 2 diabetic uraemic patients who had a history of having diabetes for more than 6 months. The patients had been under haemodialysis for more than 1 year. The study protocol was approved by the institutional ethical review board, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India, prior to the commencement of the study. Informed consents were taken from all patients.

Patients who received irradiation therapy for head and neck cancer, those who were on medications such as tricyclic antidepressants,

anticholinergics and antihistamines and patients with diabetic history of less than 6 months were excluded. The demographic data [Table/Fig-1], medical history and results of laboratory investigations were recorded by one clinician and examinations for uraemic oral manifestations and dental conditions were done by another clinician who was unaware of the medical history of each participant.

Pre–dialytic, unstimulated, whole salivary pH was recorded by using pH-measuring strips. Patients were asked to pool the saliva on the tongue and the pH strip was placed on it. The colour change was immediately matched directly with scale which was provided with the strip and the pH value was recorded in the specially designed proforma.

Oral manifestations: The specific oral manifestations were classified into subjective and objective findings. Subjective findings that were included were dry mouth, change in taste of tongue and/or burning sensation on the mucosa. To assess the subjective findings each patient was asked questions about the symptoms. Objective findings that were included were uraemic odour, tongue coating, mucosal petechiae or ecchymosis and ulceration. Uraemic odour was recorded by smelling the odour when the patient was talking. Tongue coating, mucosal petechiae or ecchymosis and ulceration were recorded under a torch light illumination. Enamel hypoplasia was noted as diffuse opacities which were seen on the surface of the teeth, which were assessed by using the criteria which were determined by Alaluusua et al., [10].

The DMFT index was recorded for the incidence of caries by using a mouth mirror and a probe. The decayed tooth were recorded as (D), missing teeth as (M) and filled teeth as (F) according to WHO criteria [11,12]. Temporary restorations were considered as decayed and the initial lesions like chalky spots and stained fissures were not considered as 'D'. All 28 teeth were examined; teeth which were not included were third molars, unerupted teeth, congenitally missing and supernumerary teeth and teeth which were removed for other reasons than dental caries such as trauma, cosmetic purposes or for use as bridge abutments. The overall DMFT value was obtained as a sum of the decayed, missing and filled teeth for each patient. The DMFT index is generally expressed as the average number of DMF teeth per person in the population which is being studied.

Coding criteria: E-Excluded tooth or tooth space, 1-sound permanent tooth, 2-filled permanent tooth, 3-decayed permanent tooth, 0-missing tooth, un-erupted tooth, impacted tooth, congenitally missing tooth and X- Extracted permanent tooth.

CPITN index: Community Periodontal Index was measured for assessment of periodontal status, by using a mouth mirror and a CPITN probe which was a specifically designed periodontal probe with a 0.5 mm ball tip and a black band between 3.5 and 5.5 mm and with rings at 8.5 and 11.5 mm from the ball tip. According to WHO protocol [13], the dentition was divided into 6 sextants which are defined by tooth numbers: 18-14, 13-23, 24-28, 38-34, 33-43, and 44-48, and it was coded as following: Code 0- healthy periodontium, Code 1-bleeding on gentle probing, Code 2- calculus deposits being felt on probing , Code 3- pocket 4-5 mm (black band on the probe partially visible), Code 4- pocket 6mm or more (black band on probe not visible) and Code x- excluded (less than two teeth present). The index teeth which have to be examined are 17, 16, 11, 26, 27, 37, 36, 31, 46, and 47. If no index teeth are present, all the remaining teeth in that sextant are examined and the highest score is recorded as the score for the sextant.

STATISTICAL ANALYSIS

Statistical analysis was done by using the software, Statistical Package for Social Sciences (SPSS, version 15.0) and SAS 9.2, and Microsoft Word and Excel were used to generate graphs, tables, etc.

RESULTS

In non-diabetic group, the youngest patient was 26 year old and the eldest patient was 67 year old. Similarly, the youngest patient was 26 year old and the eldest patient was 72 year old in diabetic group. The mean age of the patients in non-diabetic group was 55.34 years, with a standard deviation of 10.56 years and the mean age of the patients in diabetic group was 53.78 years, with a standard deviation of 11.77 years [Table/Fig-1]. Male patients were more in number in non- diabetic and diabetic groups. In non-diabetic group, 60% were male patients and in diabetic group, 68.1% were males. A minimum duration of diabetes of 2 years and a maximum duration of 23 year were found in diabetic patients. The mean duration of diabetes was 10.04 years, with a standard deviation of 4.78 years

Dysguesia was found to be significantly more prevalent in non-diabetic patients, where 90% of them were found to be positive for an altered taste sensation as compared to diabetic patients, with 68.1% being positive for an altered taste sensation ($p<0.008$). Dry mouth showed a suggestive significance statistically, with 62% of patients being positive among non-diabetics and 78.7% of diabetic patients being positive for dry mouth. Uraemic odour was found in 45 patients in non-diabetic group and in 35 patients in diabetic group on examination. Tongue coating was present in 9 patients in non-diabetic group and in 18 patients among the diabetic group on examination. A moderate significance was observed with the objective oral manifestations of uraemic odour and tongue coating, with p values of <0.044 and < 0.026 respectively [Table/Fig-2].

A statistically high significance was observed with the objective oral manifestation of mucosal petechiae, with10.0% patients in non- diabetic group as compared to 31.9% in diabetic group, who showed mucosal petechiae with a p value of <0.008 [Table/Fig-2]. Enamel hypoplasia was found to be negative in both the diabetic and non-diabetic groups, with a zero percent prevalence in the patients [Table/Fig-2].

The total DMFT score demonstrated a highly significant difference between two groups, with a mean value of 7.14 and a standard deviation of 7.77 in non-diabetics, which was less as compared to that in diabetics, with a total DMFT score of 17.75, a standard deviation of 4.92 and a p value of <0.001 [Table/Fig-3].

There was an increased pocket depth of 6mm or more in 23.4% of diabetic patients as compared to that in non–diabetic patients. A moderate significance was found, with a CPI score of 5 ($p<0.015$). A suggestive significance with ($p<0064$) was found with presentation of calculus, where 28% non-diabetic patients and only 12.8% diabetics were positive, with a CPI score of 4, [Table/Fig-4]. The mean salivary pH in the non-diabetic group was 7.14, with a standard deviation of 1.18 and in the diabetic group, the mean salivary pH was 7.02, with a standard deviation of 1.19. There was a suggestive significance statistically, with a pH value of >7.0 being recorded among 34% non-diabetics and only 17% diabetic patients ($p<0.056$) [Table/Fig-5].

DISCUSSION

CRF results in a number of systemic manifestations and oral cavity is not an exception. With widespread availability of dialysis, the lifespan of CRF patients has increased. The most common cause of CRF is diabetes mellitus, which by itself causes several oral manifestations [4-9]. Many studies have been done to evaluate oral and dental manifestations of CRF and diabetes separately, but no sufficient studies have been done to compare the oral and dental manifestations of diabetic and non-diabetic uraemic patients. The present study was done to evaluate and compare the oral and dental manifestations and salivary pH of diabetic and non-diabetic uraemic patients who were on maintenance hemodialysis.

In our study, dry mouth was seen both in diabetic and non-diabetic

Baseline information	Non-diabetic	Diabetic	p value
Total number of subjects	50	47	-
Age in years	55.34±10.56	53.78±11.77	0.495
Male	30(60.0%)	32(68.1%)	0.407
Female	20(40.0%)	15(31.9%)	
CKD duration	3.98±1.79	3.13±1.41	0.011*

[Table/Fig-1]: The non-diabetic and diabetic patients categorised according to the age, gender and CKD duration

Clinical symptoms	Non-diabetic (n=50)	Diabetic (n=47)	p value
Subjective findings			
1. Dry mouth	31(62.0%)	37(78.7%)	0.072+
2.Dysguesia	45(90.0%)	32(68.1%)	0.008**
3.Mucosal pain	18(36.0%)	14(29.8%)	0.515
Objective findings			
4.Uremic odour	45(90.0%)	35(74.5%)	0.044*
5.Tongue coating	9(18.0%)	18(38.3%)	0.026*
6.Mucosal petechiae	5(10.0%)	15(31.9%)	0.008**
7.Echymosis	0	0	-
8.Mouth Ulceration	1(2.0%)	0	1.000
9.Dry mouth	48(96.0%)	47(100.0%)	0.496
10.Enamel hypocalcification	0	0	-

[Table/Fig-2]: Comparison of oral manifestations in both the groups
+ Suggestive significance (p value: 0.05 <p<0.10) * Moderately significant (p value: 0.01<p ≤ 0.05), ** Strongly significant (p value: p≤0.01).

DMFT	Non-diabetic (n=50)	Diabetic (n=47)	p value
Decay	2.70±4.07	6.36±3.09	<0.001**
Missing	4.28±6.56	6.04±5.20	0.147
Filled	0.16±0.68	5.34±2.64	<0.001**
Total	7.14±7.77	17.75±4.92	<0.001**

[Table/Fig-3]: Comparison of DMFT score between two groups
** Strongly significant (p value : p≤0.01).

CPI	Non-diabetic (n=50)	Diabetic (n=47)	p value
Healthy	0	0	-
Bleeding	0	0	-
Calculus	14(28.0%)	6(12.8%)	0.064+
Pocket 4-5 mm	31(62.0%)	28(59.6%)	0.807
Pocket 6 mm or more	3(6.0%)	11(23.4%)	0.015*
Excluded	2(4.0%)	2(4.3%)	0.950

[Table/Fig-4]: Comparison of CPITN scores between two groups
* Moderately significant (p value: 0.01<p ≤ 0.05).

Salivary pH	Non-diabetic (n=50)	Diabetic (n=47)	p value
<7.0	17(34.0%)	17(36.2%)	0.823
7.0	16(32.0%)	22(46.8%)	0.317
>7.0	17(34.0%)	8(17.0%)	0.056+
Mean ± SD	7.14±1.18	7.02±1.19	0.623

[Table/Fig-5]: Comparison of Salivary pH between two groups
+ Suggestive significance (p value: 0.05<p<0.10)

patients, with no significant statistical difference. This was not in accordance with the previous literature reports, which had shown that dry mouth was severe in the diabetic group than in the non-diabetic group [14]. There are several reasons for the prevalence of dry mouth. The decreased salivary flow may be caused by a direct uraemic involvement of salivary glands, chemical inflammation, dehydration, mouth breathing (Kussmaul's respiration) or the medications which were being used and restricted fluid intake, irrespective of whether the patient was diabetic or not [14,15].

In the present study, dysguesia was found to be significantly more in non-diabetic than diabetic patients. A previous study had reported that the taste change was more in diabetic uraemic patients [14]. The cause of metallic taste in uraemic patients has been reported to be due to urea content in the saliva and its subsequent breakdown to ammonia and carbon dioxide by bacterial ureases [8, 15]. The change in taste can also be caused by metabolic disturbances, the use of medications, diminished number of taste buds and changes in the salivary flow and composition [16]. Kho et al., in their study, revealed that sweet and sour tastes were more seriously affected than bitter and salty tastes. The oral manifestation of tongue or mucosal pain did not show any difference among diabetic uraemic patients and the non-diabetic group. This result was inconsistent with that of the previous study [14]. Previous studies have reported a higher incidence of stomatitis in diabetic patients than in non-diabetic patients. Accumulation of ammonia, which is the breakdown product of urea, might irritate the oral mucosa, resulting in glossitis and stomatitis [15].

Uraemic fetor, which is typical of uraemic patients, is caused by high concentrations of urea in the saliva, and its breakdown to ammonia. In the present study, uraemic odour was found to be higher in non-diabetic group than in the diabetic group, which showed a moderate significance statistically, with p value being 0.044. This result was in accordance with that of the previous study, which reported a greater incidence in non-diabetic group [14].

The results demonstrated that 10% of the non-diabetic patients and that 31.9% of diabetic patients showed oral mucosal petechiae (p<0.008). This was not in agreement with the findings of the previous study [9-11]. This manifestation may be caused by bleeding tendency which was caused by abnormal thrombocyte functions and a decrease in platelet factor III. It could also relate to the anticoagulants which were used during haemodialysis [14–17] (or) uncontrolled diabetes which had destroyed the walls of the vessels, which had resulted in such symptoms. The association between the prevalence of petechiae and ecchymosis and serum anticoagulant levels requires further research.

Enamel hypoplasia was found to be negative in both the study and the control groups, with a zero percent prevalence in the patients, as the patients who were considered in our study were all adults. In the previous studies which were done on children, the authors reported that 47.4% of their renal patients had enamel defects [18,19]. These were described as diffuse opacities on the teeth, as were seen in patients with calcium deficiencies. There was not much difference in the missing teeth among the non-diabetic and diabetic groups. This was partly in agreement with the findings of previous study, which had shown that the decayed and the missing teeth were more evident among the diabetic group, owing to the decreased salivary flow and the salivary pH among the individuals [14,16]. The contradictory results in our study with respect to the missing teeth and filled teeth, showed that the patients were well motivated for regular dental check ups and dental treatments. The total DMFT score demonstrated a highly significant difference between two groups in our study (p <0.001).

In this study, salivary pH was found to be greater in the non-diabetic than in diabetic group. The mean salivary pH in the non-diabetic group was 7.14±1.18 and that in the diabetic group was7.02±1.19. There was a statistically suggestive significance, with a pH value of >7.0 being recorded among 34% non-diabetic and only 17% diabetic patients (p<0.056)

Earlier studies have indicated that oral home care practices tended to be less frequent in CKD individuals who did not seek dental care on a regular basis [20,21]. It was shown in a study, that depending upon the educational level of the patients, that is, with higher educational levels, the number of filled teeth was higher

and that oral hygiene status was improved statistically in dialysis patients [20]. We could not consider the educational levels of these patients and their oral hygiene practices in our study, to correlate the changes in the presentation of oral manifestations. All the patients who attended the haemodialysis unit in our study belonged to similar socio-economic backgrounds, which had least influence on the incidence of oral manifestations.

CONCLUSION

The present study should be further evaluated by doing long term follow up studies on larger samples. More research in this direction is needed in the future, especially those which concern associated systemic illnesses and CKD and its effects on oral manifestations. Also, other correlating factors such as duration of dialysis, duration of CKD, the medications which are being taken by patients and salivary pH and urea levels have to be evaluated, to properly assess the clinical manifestations.

ACKNOWLEDGMENT

The authors would like to thank the hemodialysis unit staff at Bhimavaram Hospitals for their help and Mr.K.P.Suresh for the help with statistical analysis.

REFERENCES

[1] Mc Creary CE, Flint SR, McCartan BE, Shields JA, Mabruk M, Toner ME. "Uremic stomatitis mimicking oral hairy leukoplakia, Report of a case. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1997; 83:350-53.
[2] Kerr AR. Update on renal disease for the dental practitioner. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2001; 92:9-16.
[3] De Rossi SS, Glick M. Dental consideration for the patient with renal disease receiving hemodialysis. *J Am Dent Assoc* 1996; 127: 211-19.
[4] Fauci A.S, Braunwald E, Kasper D.L, Hauser S.L, Longo D.L, Jameson J.L, Lascalzo J. Harrison's Principles of Internal Medicine- 7th edition McGraw-Hill *Access Medicine.* 2008; 271-83.
[5] Proctor R, Kumar N, Stein A, Moles D, Porter S. Oral Dental aspects of chronic renal failure. *J Dent Res.* 2005; 84 (3): 199-208.
[6] Klassen J T, Krasko B.M. The Dental Health Status of Dialysis Patients. *J Can Dent Assoc* 2002; 68(1):34-8.
[7] Greenberg MS, Glick M. Burket's Oral Medicine- Diagnosis and Treatment. 11th ed. B C Decker Inc; 2003.
[8] Fauci A.S, Braunwald E, Kasper D.L, Hauser S.L, Longo D.L, Jameson J.L, Lascalzo J. Harrison's Principles of Internal Medicine- 7th edition McGraw-Hill Access Medicine, 2008; 271-83.
[9] Borawski J, Borawska M .W, Stokowska W, Mysliwiec M. The periodontal status of pre-dialysis chronic kidney disease and maintenance dialysis patients. *Nephrol Dial Transplant.* (2007) 22: 457–64.
[10] Alaluusua S, Lukinmaa PL, Koskimies M, Pirinen S, Holtta P, Kallio M, et al. Developmental dental defects associated with long breast feeding. *Eur J Oral Sci.* 1996;104(5-6):493–97.
[11] World Health Organization. Oral health Surveys – Basic Methods. 3rd ed., Springer: Berlin; 1987.
[12] Wilson TG, Kornman KS. Fundamentals of periodontics. 2nd ed. Chicago: Quintessence Publishing Co.; 2003.
[13] Pilot T, Miyazaki H. Global results: 15 years of CPITN epidemiology. *Int Dent J* 1994; 44:553-60.
[14] Chuang SF, Sung JM, Kuo SC, Huang JJ, Lee SY. Oral and manifestations in diabetic and nondiabetic uremic patients receiving hemodialysis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005; 99:689-95.
[15] Kho SS, Lee SW, Chung SC, Kim YK. Oral manifestations and salivary flow rate, pH, and buffer capacity in patients with end stage renal disease undergoing hemodialysis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1998; 88:316-19.
[16] Carrasco L R., Chou J.C. Perioperative Management of Patients with Renal Disease. *Oral Maxillofac Surg Clin N Am.* 2006; 18: 203-12.
[17] Bots CP, Poorterman JHG, Brand HS, et al The Oral health status of Dentate patients with Chronic renal failure undergoing dialysis therapy. *Oral Dis*. 2006; 12:176-80.
[18] Ertugrul F, Cubukcu CE, Sabah E, Mir S. The oral health status of children undergoing hemodialysis treatment. *The Turkish Journal of Pediatrics.* 2003; 45:108-13.
[19] Yahya B.N , Ali B. The dental and oral status of children with chronic renal failure. *J Indian Soc Pedod Prev Dent.* 2007;25(1):7-09
[20] Craig RG. Interactions between chronic renal disease and periodontal disease-special review in periodontal medicine. *Oral Dis.* 2008; 14: 1–7.
[21] Bayraktar G, Kurtulus I, Kazancioglu R, Bayramgurler I, Cintan S, Bural C et al Effect of Educational Level on Oral Health in Peritoneal and Hemodialysis. *Int J Dent.* 2009;(10):1-5.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Sri Sai College of Dental Surgery, Vikarabad, Andhra Pradesh, India.
2. Professor and H.O.D Department of Oral Medicine and Radiology, Vishnu Dental college, Vishnupur, Andhra Pradesh, India.
3. Professor, Department of Oral Medicine and Radiology, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India.
4. Assistant Professor, Panineeya Dental institute And Hospital, Hyderabad, Andhra Pradesh, India.
5. Assistant Professor, Rangoonwala College of Dental Sciences, Pune, Maharashtra, India.
6. Consultant Nephrologist, Bhimavaram Hospitals, Bhimavaram, Andhra Pradesh, India.
7. Assistant Professor, Sri Sai College of Dental Surgery, Vikarabad, Andhra Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Lingam Amara Swapna,
Sri Sai College of Dental Surgery, Opposite of Shiv Sagar lake, Vikarabad, Andhra Pradesh, India.
Phone: 91-9490432356, 91-9573201334, E-mail: laswapna123@gmail.com; laswapna123@ymail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Feb 07, 2013**
Date of Peer Review: **Apr 24, 2013**
Date of Acceptance: **Jun 13, 2013**
Date of Publishing: **Sept 10, 2013**