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RESEARCH ARTICLE

“THE INFLUENCE OF HEMODIALYSIS ON ORAL HEALTH STATUS“

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Abstract

A pilot study was conducted on 42 patients, which included 21 patients with CRF undergoing hemodialysis and 21 healthy individuals without CRF. The study was conducted in Canadian Hospital in Dubai, Nephrology Department. The visits were made every day for a total period of three weeks at a rate of approximately 5 hours per day. Medical history was taken to ensure that the patients were within the inclusion criteria to exclude any other systemic complications other than CRF that could influence the periodontal and oral health status of the patients. The study protocol was explained and an informed written consent was given to each individual before participating in the study. Clinical parameters related to dental and gingival status were assessed under the supervision of an experienced dentist. Randomly selected half mouths were examined excluding the third molars. Recession, clinical attachment loss (CAL), bleeding on probing (BOP), plaque index (PI) and dental caries were also recorded. Plaque index was visually recorded based on Sillness and Loe index and any other mucosal changes. Periodontitis was diagnosed if there was at least one site with $PD \geq 4$ mm, $CAL > 1$ mm and BOP. The severity of periodontitis was classified as either severe (≥ 2 interproximal sites with $CAL \geq 6$ mm and ≥ 1 interproximal site with $PD \geq 5$ mm), moderate (≥ 2 interproximal sites with $CAL \geq 4$ mm or ≥ 2 interproximal site with $PD \geq 5$ mm) and no or mild (neither “moderate” nor “severe” periodontitis). The aim of this pilot study was to determine the impact of hemodialysis on the dental, periodontal condition and overall oral health status in patients with CRF. No significant difference could be found between the two groups with regard to DMFS, plaque index, periodontitis and BOP. The observed variations among the groups studied appear to suggest that there is a significant difference in the halitosis and number of teeth present in CKD.

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Introduction:-

Kidneys are the essential excretory organs responsible for removal of metabolic waste products, such as urea in particular, regulation of blood volume and electrolytes (Bots et al., 2006; Jain et al., 2014). Chronic kidney disease (CKD) is an irreversible reduction in glomerular filtration rate (<60 ml/min/m²) for more than 3 months and an increase of serum creatinine, blood uric nitrogen level (Wahid et al., 2013).

Etiology of chronic renal failure (CRF) is linked to hypertension, diabetes mellitus and polycystic kidney disease. Impaired kidney function is restored by dialysis therapy which is a process of eliminating nitrogenous and toxic products from the blood. There are two types of dialysis therapies: hemodialysis (HD) and peritoneal dialysis (PD). In HD a machine is used to remove excess waste product for a period of 2-3 days for around 4-5 hours, while in PD, fluid is introduced and drained from abdominal cavity numerous times during the day (Bots et al., 2006). There is a high prevalence of kidney disease in this region. Around 19% of the UAE population is expected to suffer from diabetes and 17% from hypertension. Around 40% of all these patients are expected to develop some form of chronic kidney disease in their lives (Health Authority of Abu Dhabi [HAAD], 2012).

A study conducted by Hamissi et al. in 2009 revealed that there was a significant difference between the duration of hemodialysis and its effect on oral health. The study concluded that there was a strong relation of mild to moderate gingivitis in patients undergoing hemodialysis (Hamissi et al., 2009).

CKD has a negative impact on the oral health status such as xerostomia, gingival hyperplasia, increased levels of plaque and calculus, increased prevalence and severity of destructive periodontal diseases, and gingival bleeding and pallor mucosa. In addition to erosion of lingual teeth surfaces, bone diseases, halitosis, uremic stomatitis and calcification of root canal, since patients with CKD, tend to use less dental services and oral health needs (Klassen and Krasko, 2002; Hamissi et al., 2009; Jain et al., 2014).

Periodontitis is associated with CKD by means of deep pockets and clinical attachment loss with elevated levels of *Porphyromonasgingivalis*, *Treponema denticola*, and *Tannerella forsythia* (Bastos et al., 2011; Wahid et al., 2013). There was no difference between the pocket status in CKD patients treated by hemodialysis and control group but the bleeding on probing was higher according to Bots et al. (2006). Patients on hemodialysis had less number of teeth compared to general population based on the study of Borwaski et al. (2007). According to the study conducted by Thorman et al. in 2009 (as cited in Wahid et al., 2013), patients undergoing hemodialysis had a significant increase in clinical attachment loss (CAL) compared to healthy individuals. Chambrone's study (2013) established that there was enough evidence to support a positive correlation between periodontitis and CKD as well as an affirmative impact of periodontal treatment on glomerular filtration rate (Chambrone et al., 2013). The psychological state of hemodialysis patients may have a great influence on their oral health status (Jain et al., 2014). A study done by Jain et al. in 2014 suggested that periodontal health is further debilitated by cofactors, such as displeasure, low self-esteem, anxiety, and depression.

Hemodialysis patients have lower caries rate due to elevated pH levels in saliva caused by increased urea concentration (Bots et al., 2006). However, the study conducted by Bots et al. in 2006 concluded that DMFT rate was higher in control group compared to patients with hemodialysis, the difference yet was insignificant (Bots et al., 2006). While Jain et al. (2014) mentioned that patients undergoing hemodialysis had higher incidence of tooth decay compared to control groups, no significant association was found (Jain et al., 2014).

Poor oral health is a warning sign for patients with CKD, hence oral health care awareness is strongly recommended in such patients (Akar et al., 2011), which was supported by a study conducted by Strippoli et al. (2013). Dental management of patients with renal problems should be as atraumatic as possible to avoid situations of prolonged bleeding and infection. Therefore antibiotic prophylaxis should be administered to protect vascular access sites (Craig, 2008). Periodontal inflammation is observed in CKD patients due to serum markers, C-reactive protein and albumin, which in turn leads to periodontitis (Wahid et al., 2013). Albumin, however, is a stronger indicator of inflammation compared to creative protein (Wahid et al., 2013). According to a study conducted by Kshirsagar et al. in 2007, there was a strong correlation between severe periodontitis and hypoalbuminemia in CKD patients undergoing hemodialysis (Wahid et al., 2013). Another study conducted by Ur Rahman found no significant difference in the pocket depth and gingival index (Rahman et al., 1992).

Material and Methods:-

Ethical approval was required for this study by the ethics committee in Canadian Hospital and the University Dental Hospital Sharjah (UDHS). An informed and written consent was distributed to all the participants with description of the study protocol and the clinical procedure that was conducted. The patients who were examined in Canadian Hospital had been undergoing hemodialysis whereas patients examined in UDHS were selected as the control group.

A pilot study was conducted on 21 patients treated by hemodialysis with the mean age of 40 ± 20 years and was compared to the control group with the same mean age, number of participants and gender match. All diagnostic instruments, gloves, masks, and periodontal probes were provided from University of Sharjah. The instruments were sterilized in UDHS sterilization station and transported to Canadian Hospital in sterilized pouches which were placed in a box. After the intraoral examination was done the instrument was inserted in pouches and placed in a closed box and returned to UDHS for sterilization. Oral hygiene and brushing habits along with the medical and dental history of the patients was recorded. Only patients who approved the consent form were included in the study. In addition, this study included patients with controlled diabetes or patients undertaking anti-inflammatory and immunosuppressant drugs. On the other hand, pregnant women and smokers were excluded from the study. Uncontrolled diabetes patients who received periodontal treatment and who used antibiotic during the last three months were also excluded.

Two calibrated final year dental students who used dental diagnostic kit, Williams probe and light source on the dental chair side performed intraoral examination. Examiners were blinded about the patient's medical status. One of the researchers was responsible to communicate with the nurse in the nephrology department to take the history and explain the protocol of the study to the patients. Randomly selected half mouths were examined excluding the third molars. Recession, clinical attachment loss (CAL), bleeding on probing (BOP), plaque index (PI) and dental caries were recorded. Plaque index were recorded visually based on Sillness and Loe index on the buccal and lingual surfaces of the most posterior tooth, and buccal surface of the canine based on the quadrants selected. Measurements were conducted on four surfaces (buccal, lingual, mesial, and distal) recording the deepest pocket depth of ≥ 4 mm. Periodontitis was diagnosed if there was at least one site with $PD \geq 4$ mm, $CAL > 1$ mm and BOP. The severity of periodontitis was classified as either severe (≥ 2 interproximal sites with $CAL \geq 6$ mm and ≥ 1 interproximal site with $PD \geq 5$ mm), moderate (≥ 2 interproximal sites with $CAL \geq 4$ mm or ≥ 2 interproximal site with $PD \geq 5$ mm) and no or mild (neither "moderate" nor "severe" periodontitis). The mean PD and CAL were calculated according to the measurement of the four surfaces. Halitosis was recorded as either absent or present. Oral findings such as: Candida, pallor mucosa, erosion of the lingual tooth surfaces and uremic stomatitis was also recorded. After drying the tooth by air, DMFT score was measured by recording the number of carious teeth.

At the end of the study, all data were collected and summarized, and the results were tabulated according to control group and HD group. A statistical analysis was further established using SPSS software and t-Test.

Results:-

In our study, there were 21 subjects undergoing hemodialysis and 21 healthy individuals. The mean age of the participants in this study was (42.76). The data analysis was conducted using the SPSS software and t-test for equality. A self-administered questionnaire and clinical examination were conducted for both study groups. Regarding the oral hygiene, 15 of the hemodialysis patients (71.4%) reported brushing while 1 patient (4.8%) used dental floss. Comparatively to the control group, 18 reported brushing (85.7%) and 3 (14.3%) used dental floss. The majority of the patients in both groups were non-smokers; however, 7 of the hemodialysis patients were former smokers with percentage of 33.3%. The result of this study showed that there is an evidence of high prevalence of halitosis among patients undergoing hemodialysis ($P = .000$). Even though, there were no significant differences between the two groups, 3 of the hemodialysis patients (14.3%) had oral candida ($P = 0.072$).

In relation to plaque score, no significant difference was noted between the hemodialysis group and the control group with p value of ($P = 0.726$). Upon analysis of the periodontal conditions of the two groups there were no significant differences analyzed in pocket depth and CAL measurements ($P = 0.460$). As for BOP, there was no significant difference with p value of ($p = 0.417$). The mean results for BOP in hemodialysis patients were 52.6 whereas the mean value in the control group was 44.40. Although there was no significant difference in the severity of periodontitis, 23.8% of the hemodialysis patients had severe periodontitis compared to the 9.5% subjects in the control group. However, there was a significant difference between both groups in the number of teeth present with

p value of (P = 0.025) with average of 21.19 for hemodialysis group compared to 25.24 in the control group. Moreover there was no statistical difference in DMFS score between the two groups with an average of 14.48 for hemodialysis patients and an average of 12.95 for control group (P = 0.487). The clinical and periodontal characteristics of the study group are shown in Table 1 and Table 2.

Table 1:- Clinical and demographic data of patients undergoing hemodialysis and their health control

Variables	Hemodialysis Mean (SD)	Control Mean (SD)	P value
DMFS	14.48 (4.9)	12.95 (8.65)	.487
Plaque	1.76 (0.43)	1.71 (0.46)	.726
BOP	52.61 (26.46)	44.45 (37.1)	.417
Number of teeth present	21.19 (7.16)	25.24 (3.53)	.025

Table 2:- Mean DMFS, plaque, BOP, and number of teeth present for hemodialysis patients and their healthy control.

Variables	Hemodialysis N (%)	Control N (%)	P value
Halitosis Absent Present	4 (19.0)	19 (90.5)	.000
	17 (81.0)	2 (9.5)	
Candid Absent Present	18 (85.7)	21 (100)	.072
	3 (14.3)	0 (0.0)	
Plaque visible at gingival margin present elsewhere	5 (23.8)	6 (28.6)	.726
	16 (76.2)	15 (71.4)	
Tooth Brushing No Yes	6 (28.6)	3 (14.3)	.259
	15 (71.4)	18 (85.7)	
Interdental Cleaning No Yes	20 (95.2)	18 (85.7)	.293
	1 (4.8)	3 (14.3)	
Smoking No Former	14 (66.7)	20 (95.2)	.018
	7 (33.3)	1 (4.8)	
Severity No or mild Moderate Severe	9 (42.9)	11 (52.4)	.460
	7 (33.3)	8 (38.1)	
	5 (23.8)	2 (9.5)	

Discussion:-

Before conducting our research, our hypothesis regarding the effect of hemodialysis on oral health status included less DMFS, more periodontitis, more plaque, less number of teeth present, more halitosis, and more mucosal changes among the hemodialysis patients. These predictions were based on the assumption that changes in the PH of salivary flow, urea concentration and elevation of C reactive protein in the blood circulation would lead to more periodontal destruction. As for the reason of reduced number of teeth, this could be related to caries or bone loss.

In this study, the oral health status of 21 patients undergoing hemodialysis was assessed and compared to a corresponding 21 control group of healthy individuals. The intra-oral examination included recession, clinical attachment loss (CAL), bleeding on probing (BOP), plaque index (PI), DMFS, presence or absence of candida

infection and halitosis. The study revealed higher halitosis score in the hemodialysis group than in their systemically healthy counterparts which is a very well-known sign among CKD patient.

In this study, although not statistically significant, hemodialysis patients had more severe periodontitis when compared to control and more bleeding due to high levels of C-reactive protein in their blood. Likewise, Wahid et al. (2013) had similar findings regarding the severity of periodontitis. Lack of participants was the major drawback of insignificant difference in periodontitis among hemodialysis and control group patients which could be resolved by a larger population group.

It has been suggested by others that caries activity in hemodialysis patients is higher (Jain et al., 2014). We have also established marginally higher DMFS score in hemodialysis patients (not statistically different). Although the difference was insignificant according to Bots study, the caries rate was lower (Bots et al., 2006). On the other hand, Jain et al. (2014) concluded that the less DMFS scores among hemodialysis were due to an elevated PH of saliva and a strict diet.

Some investigators have found pallor mucosa, uremic stomatitis, halitosis, gingival bleeding, erosion of lingual tooth surfaces, bone diseases, elevated scores of plaque and calculus, with higher prevalence and severity of destructive periodontal diseases as patients with CKD have a tendency to use less oral health and dental services (Klassen and Krasko, 2002; Hamissi et al., 2009; Jain et al., 2014). Even though there were no differences in plaque score measurements, severe periodontitis were found among hemodialysis subjects. Possible explanation for the discrepancies may be the relatively related small study groups, different medical treatments, socioeconomic factors, and the treatment duration and instability of renal function at the time of examination. Akin to our study results, some investigators have found no significant difference in the pocket depth and plaque scores between the two groups. Similarly, one study conducted by Bots et al. have found more BOP among the hemodialysis patients, which was equivalent and analogous to our findings.

Conclusion:-

In conclusion, we found that there was no correlation between hemodialysis and oral health. However, there was a distinctive oral malodor found among hemodialysis patients. There have been many studies that have aimed to establish a relationship, but an evident correlation still needs to be ascertained. Therefore, further studies with sufficient confounding variables within large study population should be performed for more accurate results. Improving oral health and treating periodontal disease might minimize risk of periodontal disease development regardless of CRF. It is the dentist's role to motivate and educate patients and their caregivers to maintain good oral health care status by providing chair side counseling and reassurance. Caring for CKD patients is a multidisciplinary task, so all professionals should correlate with each other to provide the best treatment options.

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