EGYPTIAN DENTAL JOURNAL
www.eda-egypt.org
VOL. 70, 2167:2173, JULY, 2024
PRINT ISSN 0070-9484 • ONLINE ISSN 2090-2360
ORTHODONTICS, PEDIATRIC AND PREVENTIVE DENTISTRY
Submit Date : 28-02-2024 • Accept Date : 09-03-2024 • Available online: 01-07-2024 • DOI : 10.21608/EDJ.2024.273240.2961

ASSESSMENT OF ORAL HEALTH STATUS IN A GROUP OF EGYPTIAN CHILDREN UNDERGOING HEMODIALYSIS: AN OBSERVATIONAL STUDY

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ABSTRACT

Aim: The study aimed to assess the oral health status of a group of Egyptian children with chronic kidney disease undergoing hemodialysis.

Methodology: A total of 69 children were included in this study. Clinical examination included the following parameters: caries status, periodontal health, oral hygiene, presence of any developmental defects of enamel, oral mucosa, and soft tissues.

Results: Within the results, 71% of the children were caries-free and the mean values of DMF and def indices for caries-affected children were 0.53±1.23 and 1.48±1.77 respectively. The mean values of simplified oral hygiene and gingival indices were 1.15±0.79 and 0.54±0.5 respectively. Also, 62.32% of studied children were affected with variable presentations of enamel developmental defects. No soft tissue abnormalities were found in studied children except for mucosal pallor in 46.38% of children.

Conclusion: It was concluded that chronic kidney disease and hemodialysis have a negative impact on the oral health of children.

KEYWORDS: Oral manifestations, Hemodialysis, Dental caries, Oral hygiene, Developmental defects of enamel

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INTRODUCTION

Chronic kidney disease (CKD) is a multi-symptomatic condition that occurs due to a decrease in the number of active nephrons. Diagnosis of CKD depends on renal abnormalities and glomerular filtration rate below 60 ml/min/1.7 m^2 [1]. CKD is a significant health problem in children which influences their quality of life. If left untreated, patients develop irreversible end-stage renal failure which can only be managed by renal replacement therapy in the form of hemodialysis (HD), peritoneal dialysis, or renal transplantation [2,3].

Children with CKD have many oral manifestations resulting from the condition itself, its treatment, or both. Oral manifestations include a uremic odor, gingival enlargement, enamel hypoplasia, dental calculus, xerostomia, and uremic stomatitis [4].

Unfortunately, in developing countries like Egypt, oral health care in children with CKD is neglected due to poor dental awareness among the children and health care personnel which leads to poor quality of life for those children [7]. There is a deficiency of literature addressing the oral health status of Egyptian children with CKD.

SUBJECTS AND METHODS

Study design

This study was an observational study conducted on 69 children undergoing HD in the Pediatric Nephrology Unit of Al Demerdash Hospital and Abu El Rish Hospital in Cairo, Egypt.

Sample size estimation

Based on the results of **Abdellatif *et al.*** [7], by adopting a confidence interval of (95%), and a desired width of confidence interval (d) of 0.6; the predicted sample size (n) was found to be **(69)** cases.

Subjects' Recruitment

The study consisted of a convenient nonrandomized sampling of children undergoing HD who met the eligibility criteria. Inclusion criteria included children of both genders with an age range of 6-12 years who have been on HD for more than one year. Exclusion criteria included children with uncontrolled medical conditions or patients who had periodontal/dental therapy within the last 6 months [11].

Data collection

Information regarding sociodemographic data, dental history, and oral hygiene habits were collected through face-to-face interviews. Medical history and relevant clinical data were obtained from the medical files.

Clinical examination

All children were examined by one calibrated examiner while they were seated on the dialysis beds during their HD session [13,14]. The oral examination was done according to the World Health Organization criteria [15]. The following clinical parameters were assessed: caries status, periodontal health, presence of any developmental defects of enamel (DDE), oral mucosa, and soft tissues.

Assessment of dental caries was done using the Decayed, Missing, and Filled (DMF) index [16] for permanent dentition and the decayed, extracted, and filled index (def) [17] for deciduous teeth in children with mixed dentition stage. Examination of the dentition was carried out in an orderly manner and if a permanent and deciduous tooth occupy the same tooth space, the status of the permanent tooth only was recorded.

Assessment of periodontal health included assessment of oral hygiene using the Simplified Oral Hygiene Index (OHI-S) [18], while gingival health was assessed using the Gingival Index (GI) [19]. Teeth were also examined for the presence of

DDE using the DDE-modified index [20]. Teeth were inspected without drying, only gross food debris was removed using cotton rolls, and the status of the tooth/individual was defined according to the most severe defect found. Soft tissues were examined for the presence of any mucosal lesions [21].

Data management and statistical analysis

Descriptive statistical analyses were conducted utilizing the Microsoft Office Excel 2019 software package.

RESULTS

Sociodemographic data

This study included 69 children undergoing HD with a mean age of 10.39±1.98 years old, and the percentage of males to females was 59.42% and 40.58% respectively. The results showed that 56.52% of studied children regularly attended school, however, 43.48% of them only attended for their final exams. Furthermore, 55.07% of children reported living in Cairo while 44.93% came from governorates other than Cairo. It was also found that 97.1% of studied children did not brush their teeth, while only 2.9% of the children performed irregular tooth brushing. Also, none of the children had previous dental visits.

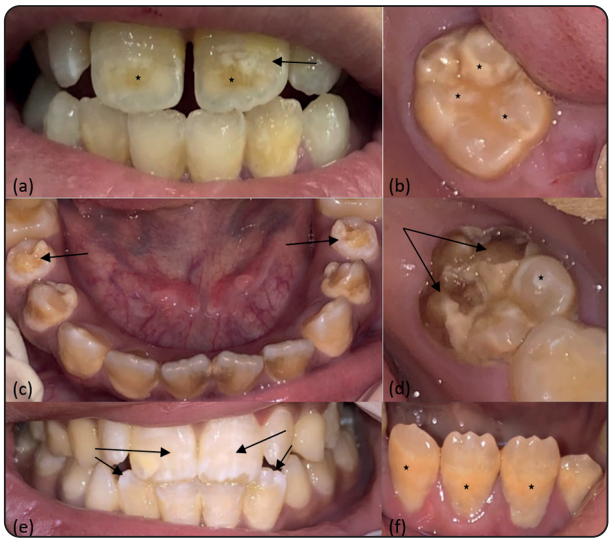

Fig. (1) Intraoral photographs showing different forms of DDE.

(a) Shows diffuse linear opacities marked with arrows and yellowish brown diffuse patchy opacities marked with asterisks. DDE index Code 4

(b) Shows demarcated white opacities marked with asterisks. DDE index Code 1

(c) Shows enamel hypoplasia with missing enamel marked with arrows. DDE index Code 8

(d) Shows enamel hypoplasia with missing enamel marked with arrows and demarcated white opacities marked with asterisks. DDE index Code 8

(e) Shows diffuse confluent opacities marked with arrows. DDE index Code 5

(f) Shows intrinsic staining marked with asterisks. DDE index Code 9

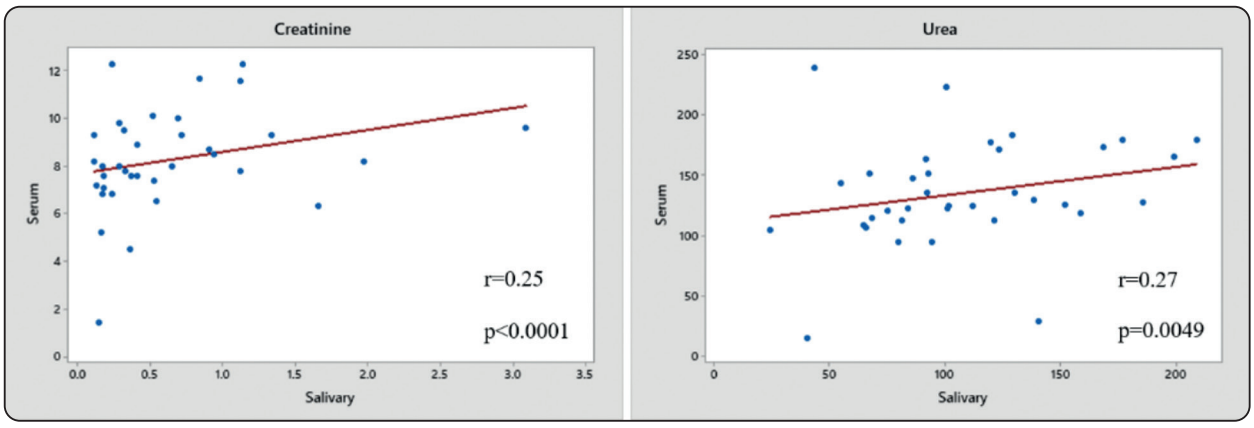

Fig. (2) Correlation between salivary and serum levels of urea and creatinine

Clinical Parameters

Regarding the assessment of dental caries, 71% of the children were caries-free and the mean values of DMF and def indices for caries-affected children were 0.53±1.23 and 1.48±1.77 respectively. Regarding the assessment of periodontal health, all children had variable levels of debris, however, 59.42% of children had dental calculus. The mean values of OHI-S and GI were 1.15±0.79 and 0.54±0.5 respectively. Also, 62.32% of children were affected with variable presentations of DDE. No soft tissue abnormalities were found except for mucosal pallor in 46.38% of children.

DISCUSSION

Children with CKD face reduced life span, poor health-related quality of life, and significant symptom burden [2,3]. They also have variable oral manifestations affecting both soft and hard tissues compared to their healthy peers [11].

Results revealed that the mean age for studied children was 10.39±1.98 years old and the percentage of males (59.42%) was higher than females (40.58%), which may be explained by the increased prevalence of CKD among males[26]. Also, the frequent absence of school among 43.48% of the children reflects the effect of CKD on children's daily life activities. Furthermore, 44.93% of children traveled to receive their treatments in Cairo due to the limited availability of kidney centers. This traveling burden, the need for frequent HD sessions, and the complications of HD represent barriers that could prevent children from regular school attendance with subsequent lower educational levels and academic delay.

Clinical examination revealed that 71% of studied children were caries-free and the mean DMF and def indices values for caries-affected children were 0.53±1.23 and 1.48±1.77 respectively. This low caries prevalence is in accordance with previous studies [11,27–32] and could be attributed to high salivary urea levels leading to alkaline salivary pH which allows acids neutralization and protection against demineralization. Also, high salivary phosphate levels, due to systemic hyperphosphatemia, increase salivary buffering capacity and promote remineralization of incipient carious lesions [11,27–32].

However, **Weraarchakul** [33] disagreed and reported higher caries prevalence in children with CKD. This difference between the studies may be due to geographic differences between studied populations and the age of onset of CKD.

Results also showed that calculus deposition was more prevalent than debris accumulation in studied children. This finding is in agreement with previous studies [11,28,34] and could be attributed to increased salivary urea concentration which has an inhibitory effect on debris retention despite oral hygiene negligence and leads to increased salivary pH favoring calculus formation. Also, high phosphate levels and low magnesium levels lead to precipitation of calcium-phosphorus and calcium oxalate, and calculus formation.

Despite the assumption that accumulation of debris precedes calculus formation, the previous findings suggest that calculus deposition is mainly due to changes in the oral environment related to CKD and not due to calcification of accumulated debris [11,28,34]. However, lower calculus prevalence was reported by **Weraarchakul** [33] which may be explained by the early and proper control of CKD leading to minimal disease complications, and improved oral health awareness among studied children.

These clinical findings are supported by the data collected during interviewing the children and their parents. All participating children had no previous dental visits and only 2.9% of them performed irregular tooth brushing, which adds weight to their oral health negligence and lack of awareness among families and health care personnel. The poor

oral hygiene status of those chronically ill children reflects that oral health care is not on their scale of values as they are burdened enough with their systemic condition.

However, **Xie *et al.*** [14] and **Ziebolz *et al.*** [35] reported that patients on HD practiced regular oral hygiene and had increased awareness. These studies differed in the geographic distribution of the target population as they lived in developed countries. Moreover, most children in the current study belong to families of low education and socioeconomic levels which could influence their perception of the importance of oral health. **Bayraktar *et al*.** [36] discussed the effect of educational level on the oral findings of patients with CKD and reported that oral health was better in patients with higher educational levels than lower educational levels. This finding highlights the need for incorporating oral health care programs as part of the overall health care for children with CKD in developing countries like Egypt.

Regarding assessment of gingival health, 82.6% of children had mild gingivitis. This increased prevalence of mild gingivitis may be attributed to systemic uremia and uremic stomatitis. Yet, moderate and severe gingivitis were found in only 13.05% of children which may be explained by the mucosal pallor due to anemia masking gingivitis. This finding is in line with **Andaloro *et al.*** [11] and **El-Saied *et al.*** [28], yet, it contrasts **Weraarchakul**[33] and **Martins *et al*.** [37]. The difference between studies could be attributed to differences in patients' education and socioeconomic levels.

Increased prevalence of DDE was found in 62.32% of children which is in accordance with previous research[11,28,30,31]. DDE in CKD occur due to disturbances in calcium and phosphate metabolism, which affect the mineralization of hard dental tissues. Also, low protein diet and proteinuria are responsible for defective enamel matrix formation and enamel hypoplasia. Moreover, the adsorption of urea into the dentin matrix during tooth development may result in intrinsic discoloration.

However, the present findings contrast with **Weraarchakul** [33] and **Ali *et al.*** [27] who reported a low prevalence of DDE in examined children which may be explained by the early and proper control of CKD with minimal complications. Moreover, the prevalence of DDE is dependent on the age of onset of CKD, as the uremic and metabolic disturbances affect teeth during earlier phases of development.

Mucosal pallor was found in 46.38% of studied children, as a sign of anemia commonly associated with CKD. This finding is in accordance with **Marinoski *et al.*** [21]. Biochemical salivary analysis showed increased levels of salivary urea and creatinine which could be explained by diffusion of these molecules from serum into saliva [22,38,39]. The increased salivary urea levels are in agreement with previous studies [38,40]. Moreover, increased salivary creatinine levels are similar to the results of **Alpdemir *et al.*** [22] and **Renda *et al.*** [39].

CONCLUSIONS

Within the limitations of this study, it can be concluded that CKD and HD have a negative impact on the oral health status of children represented by increased prevalence of gingivitis, calculus depositions, DDE, and mucosal pallor. Yet, children on HD have low caries prevalence.

CONFLICT OF INTEREST STATEMENT

The authors reported no conflicts of interest related to this study.

ETHICAL APPROVAL

The protocol for this study was approved by the Research Ethics Committee - Faculty of Dentistry - Ain Shams University. Approval number (FDASU-RECEM102101). Parents of children who agreed to participate in the study were asked to sign informed consent after a brief description of the study.

Also, assent was taken from all participating children. The study was performed per the ethical standards laid down in the Declaration of Helsinki.

FUNDING ACQUISITION

Self-financed.

ABBREVIATIONS

CKD: chronic kidney disease, HD: hemodialysis, DDE: developmental defects of enamel, GI: gingival index, OHI-S: oral hygiene index simplified, DMF: Decayed, Missing, and Filled teeth index, def: decayed, extracted, and filled teeth index, SD: standard deviation

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