

## Oro-Dental Health Status and Salivary Characteristics in Children with Chronic Renal Failure

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### Abstract:

Children suffering from decreased renal function may demand unique considerations regarding special oral and dental conditions they are encountered to. It is mentioned that renal function deterioration may affect the hard or soft tissues of the mouth. Having knowledge about the high prevalence of dental defects, calculus, gingival hyperplasia, modified salivary composition and tissue responses to the dental plaque may aid the physician and the dentist to help nurture the patient with chronic renal failure through the crisis, with an aesthetically satisfying and functioning dentition.

**Key Words:** Kidney Failure; Oral Health; Saliva

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### INTRODUCTION

Chronic renal failure (CRF) is known as insufficiency of renal function and an irreversible reduction of glomerular filtration rate that happens over years [1-3]. Its incidence varies from one country to another, as 337, 90, 95 and 107 new cases per million people/year have been reported in the United States, Australia, United Kingdom and New Zealand, which makes CRF an important health care problem [4]. The overall prevalence of chronic renal failure in Iran is 18.9% [5]. Hypertension, diabetes mellitus, uropathy, chronic glomerulonephritis and auto immune diseases are

the most common causes of renal failure in adults. The most frequent etiological factors responsible for chronic renal failure in children are congenital renal diseases as urological malformations, hereditary nephropathy and glomerular diseases [6]. Despite various etiologies, clinical manifestations of CRF are similar [3,7]. Primarily, CRF children consume a protein sparing diet supplemented with calories. Children enduring renal failure demonstrate growth retardation at young age and the development of dentition is delayed too [8]. Because of the increasing survival rate of patients suffering from renal failure, due to advances in

pediatric nephrology such as dialysis and transplantations, and many metabolic changes associated with CRF and its treatment, it is of great importance for the physician and dentist to get familiar with oro-dental alterations occurring with this illness [2,9]. Although the new preventive or treatment methods have minimized the complications of chronic renal disease, these remedial advances have caused some concerns about oral health [2]. Oral symptoms are observed in 90% of renal patients, as the disease itself and its treatment have systemic and oro-dental manifestations [3,4,10,11]. Many changes such as alteration in salivary composition [12-14], flow rate [14-16], higher prevalence of dental calculus [17], enamel hypoplasia [15,18], low caries rate [16,18,19], poor oral hygiene and uremic stomatitis may affect the oral cavity. It is also associated with loss of lamina dura, bony fractures, bone tumors, loosening of teeth and malocclusions [20]. Medical treatment procedures in these patients may be postponed due to the unsatisfactory oral health status and the potential risk of post surgery infection, which may be life threatening [21]. In addition, improving oral hygiene and performing any necessary dental and oral treatment prior to hemodialysis or transplantation may prevent endocarditis, septicemia and end arthritis [22]. The aim of this review is to provide the dentists with information about each of the oral and salivary changes in children and adolescents with decreased renal function.

#### **Oral mucosa status:**

Erythropoietin reduction and the resultant anemia lead to pallor of the oral mucosa. Other manifestations such as petechiae, pigmentation of the oral mucosa and ecchymosis are also observed in renal disease patients. Stomatitis, mucositis and glossitis are reported in CRF patients, which may cause pain and inflammation of the tongue and oral mucosa. Altered taste sensations and dysgeusia as well as bac-

terial and candidiasis infections may arise due to the underlying renal disease [23].

There has been a low frequency of periodontal or gingival disease reported in children with CRF [8,16,24]. This may be attributable to the fact that immunosuppression and uremia associated with CRF and hemodialysis may alter the inflammatory response of gingival tissue to the bacterial plaque [25]. In addition, the pallor caused by anemia [common systemic manifestation of reduced renal function] may mask the inflammatory signs of the gingiva [24]. Gingival enlargement (GE) is of greater importance among these patients compared to normal children. This may be related to the drugs they receive. Significantly higher prevalence of gingival enlargement is reported in children undergoing treatment with nifedipine and/or cyclosporine A (13%-85%), commonly used following kidney transplantation [16,24,26-29]. Although poor oral hygiene is mentioned as an associated factor in gingival growth development, once gingival enlargement occurs, increased oral hygiene alone is rarely sufficient in alleviating GE, particularly in severe types [24,26].

After establishment of an optimal, standard oral hygiene, gingivectomy by laser, periodontal knives or electrosurgery is carried out [26]. Pertaining meticulous oral hygiene after surgery is essential in avoiding GE recurrence. For 3-4 days following surgery because of gingival tenderness, dental plaque control is accomplished by chemotherapeutic agents such as 0.2% chlorhexidine gluconate mouthwashes. The patient will be able to clean and brush the teeth normally after the healing process has sufficiently progressed [26,24].

Uremic stomatitis is one of the oral complications associated with uremia occurring in advanced renal failure [3]. An acute increase of blood urea nitrogen (BUN) level [higher than 300 mg/ml] may act as an etiologic factor for this red mucosal lesion covered by a pseudo-membrane or ulcerative coating. Usually the

lesions appear on the dorsal, ventral or lateral of the tongue, retro-molar areas or buccal mucosa. Histologically, a hyperplastic epithelium with an unusual hyperparakeratinization and a minimal inflammatory infiltration are seen. Treatment of the underlying renal failure and establishment of an adequate oral hygiene will be essential for successful lesion resolution [3,31-33].

### **Dental status:**

#### ***Enamel defects:***

Disruptions during the histodifferentiation, apposition and mineralization stages of tooth development result in tooth structure abnormalities [26]. Renal dysfunction as a systemic disorder may lead to enamel hypoplasia [34,35]. Enamel defects were observed in 57%-83% of CRF children with permanent teeth, which was much more than the similar defects observed in their control groups (22%-33%) [16,25]. The age of the patient, timing and duration of the systemic metabolic disease indicates the extent and position of the defects [34,36]. One factor responsible for the disruption is abnormal calcium-phosphorous (Ca-P) metabolism [17], which causes an elevation in serum P and a reduction of plasma Ca [14,37]. Thus, the enamel defects noted in these patients were typical of that observed in children with Ca deficiency [20]. On the other hand, the plasma fluoride concentration may be elevated due to renal function deterioration, leading to dental fluorosis [35].

#### ***Dental calculus and staining:***

Calculus has an important effect on gingival and periodontal disease incidence [26]. It is mainly formed by plaque calcification, a procedure in which the balance between the inorganic and organic components of saliva is of great importance [17,26]. Abundant calculus formation is rarely seen in healthy children [26]; however, children with chronic renal failure demonstrate an elevated level of calcu-

lus [12]. Martins reported a prevalence of 86.6% for calculus formation in CRF children and 46.6% for their healthy controls [15]. Patients suffering from chronic kidney disease demonstrate alterations in salivary Ca, P, Mg, oxalate (Ox), urea and PH levels [15,17]. Elevated salivary PH, in addition to decreased salivary Mg and a higher concentration of salivary urea and phosphorus leads to Ca-P and Ca-Ox precipitation and dental calculus formation. The most prevalent site for calculus formation is the lingual surface of lower incisors, due to their proximity to the submandibular glands orifices, acting as a reservoir of Ca and P ions. However, abundant calculus formation may be observed in other parts of the oral cavity [17]. The enormous disturbances in Ca-P metabolism in CRF patients often lead to cardiovascular complications such as uremic vasculopathy, which is the major cause of morbidity and mortality in these patients [38,17]. Children suffering from CRF may demonstrate brown intrinsic discoloration due to the underlying uremia. Intrinsic stains are also observed in renal patients who were prescribed tetracycline for their infections during hemodialysis. In addition, because of the insufficient production of erythropoietin by the diseased kidneys, anemia is observed in the majority of patients with CRF. Oral iron supplements administered for treating anemia give rise to vast dental staining (13.3%) and delayed tooth eruption (26.6%). These oral manifestations are rare in normal children [15,20].

#### ***Dental caries:***

Since children with chronic renal failure have to minimize the consumption of the nitrogenous producing foods, a carbohydrate rich diet is recommended for these patients [24]. Poor oral hygiene, pre existing enamel hypoplasia, low salivary flow rate and their unique nutrition type increase the risk of caries formation in children enduring renal malfunction [15,16].

Despite the facts mentioned above, many studies have reported the dramatically lower caries prevalence (8.5%) in these patients compared to their control groups [40%] possibly because of higher salivary buffering and PH due to an elevated salivary urea concentration and a decreased isolation frequency of *Streptococci mutans* [15,16,24]. In addition, an altered acid production procedure from carbohydrates by plaque is observed in chronic kidney disease patients. This is related to the elevated salivary urea concentration, which leads to a 10-fold less H<sup>+</sup> ion production by dental plaque in CRF children [19].

#### **Radiographic findings:**

Vitamin D metabolism is mostly impaired in subjects enduring renal disease, leading to deficient Ca absorption and as a consequence of this matter, cyst-like radiolucencies in the jaws, loss of lamina dura, osteoporosis [bone demineralization], metastatic calcification, brown tumors, pulp canal obliteration and thick predentin is observed frequently [8,16,24,37,39,40]. In spite of distorted vitamin D metabolism, radiographs demonstrate a slight delay in dental eruption [2]. Besides, hypocalcemia may cause short-root syndrome in dentition [36].

#### **Salivary status:**

Saliva has an important role in caries resistance of the teeth. It acts as a protective medium, which promotes dental remineralization during and after carious attacks [26]. Decline in renal function appears to have great impacts on the salivary composition and flow characteristics [15,17]. In this regard numerous studies noted that salivary proteins, potassium, sodium, urea and creatinin concentrations were greater in CRF patients, thus causing increased PH values and buffering capacity of the saliva [15,17,41]. Salivary urea acts as a substrate in producing ammonia by dental plaque, preventing the PH to fall to the levels at which dental

demineralization occurs [19].

A decreased stimulated and non stimulated salivary flow rate is reported by some workers in children receiving hemodialysis compared to healthy controls [15,16,24], counting as a caries formation risk factor [26]. Decreased salivary flow rate in CRF patients may be due to the direct uremic involvement of salivary glands or the restricted fluid intake in these children [42].

#### **Oral malodor:**

Oral malodor commonly occurs in renal disease patients. Salivary reduction, infections and poor oral hygiene may give rise to this side effect. Presence of toxins due to inadequate clearance during dialysis is the major reason for uremic odors which may occur in 71.1% of these patients [23].

#### **CONCLUSION**

The prevalence of calculus and stain formation, gingival enlargement, bone defects and dry mouth is greater in children with renal impairment. The high occurrence of dental defects such as enamel hypoplasia, poor oral hygiene and altered salivary characteristics in children with CRF makes a periodic dental visit and parental surveillance essential to improve the oral health status.

Children undergoing strict treatment routines such as hemodialysis have got less time for preventive or treatment procedures regarding their oral ailments; therefore, the incorporation of dental service into their medical program and oral hygiene care may be crucial.

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