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End-Stage Kidney Disease and Oral Health: Information for Dental Practitioners

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**make
history.**

Chronic kidney disease (CKD) is generally referred to as gradual loss of kidney function and/or presence of kidney damage with implications for health and lasting for three or more months, regardless of the cause.^{1,2} CKD has been recognized as a leading public health problem worldwide with a global estimated prevalence of 13.4%.^{2,3} CKD has been associated with considerable levels of mortality and morbidity. For example, the mortality rate attributed to CKD is estimated to increase from 122 per million people in 2012 to 140 per million people in 2030 while CKD had accounted for approximately 3 million disability-adjusted life –years in 2012.³

The total amount of liquid filtered by kidneys per minute is called the glomerular filtration rate (GFR). GFR is considered to be the best overall index of kidney function in both health and disease given that GFR declines with persistent damage to kidney structure and a bulk of other kidney functions deteriorate along with the reduction in GFR.¹ Normal GFR values are approximately 120–130 mL/min/1.73m² and vary according to age, gender, and body size.^{1,2} The damage to and/or dysfunction of kidneys can last and get worse, leading to different stages of CKD. Depending on GFR, CKD is broadly divided into five stages (Table 1). End-stage kidney disease (ESKD) is the last stage where the GFR falls below 15, and the patient needs renal replacement therapy (RRT) - dialysis and/or kidney transplantation.^{1,4} Blood tests show the estimated glomerular filtration rate (eGFR) and help diagnose different stages of damage/dysfunction.

Table 1. CKD classification based on GFR

GFR (ml/min/1.73m ²)	CKD stage
≥90	Stage 1: Normal
60-89	Stage 2: Mild
45-59	Stage 3a: Mild to moderate
30-44	Stage 3b: Moderate to severe
15-29	Stage 4: Severe
<15	Stage 5: ESKD

GFR of <60ml/min/per 1.73m² has been regarded as the cut-off for diminished GFR while the presence of markers such as albuminuria and abnormalities in urinary sediments, electrolytes, histology

or structure (detected by imaging) has been considered to be suggestive of kidney damage.⁴ Accordingly, the latest international guidelines suggest that the diagnosis of CKD should be based on the presence of GFR of <60ml/min/per 1.73m² or one or more markers of kidney damage, or both, for 3 months or more.⁴

Global Epidemiology of End-Stage Kidney Disease

The number of treated ESKD patients has increased worldwide, likely due to improving ESKD survival, population demographic shifts, higher prevalence of ESKD risk factors such as diabetes, hypertension and obesity, and increasing access to RRT in countries with growing economies. Country- or region-specific register systems such as transplant registries usually report information on ESKD. Worldwide, the number of patients with ESKD requiring RRT is estimated between 4.9 and 7.1 million although only about 2.6 million of them have received RRT.³

Epidemiology of End-Stage Kidney Disease in Australia and New Zealand

New cases of treated ESKD in Australia were 3,100 in 2018. Over the past three decades, age standardised incidence rates of treated ESKD in Australia have virtually doubled from 6 persons per 100,000 population in 1989 to 11 persons per 100,000 in 2018.⁵ In 2018, there were 619 ESKD patients among New Zealand adults and children who were on RRT, which was equal to 127 per million of population. The proportion of the New Zealand population with ESKD receiving RRT was similar to that of Australia (127 versus 124 per million of population in 2018).⁵ The main cause of ESKD is diabetes, with the proportions attributed to diabetes being 38% and 47% in Australia and New Zealand respectively.^{5,6} Incidence rate of treated ESKD is about 7 times higher among Indigenous Australians than their non-Indigenous counterparts,⁵ while the respective rates for Maori and Pasifika Indigenous groups in New Zealand are 4-to 7-fold greater than those for non-Indigenous New Zealanders.⁶ These findings suggest that ESKD burden among Indigenous populations in Australia and New Zealand is substantially higher than non-Indigenous.

Clinical features of ESKD

Some common symptoms and signs of ESKD are⁷⁻¹²:

- Nausea
- Vomiting
- Loss of appetite
- Fatigue and weakness
- Sleep disturbance
- Oliguria
- Decreased mental sharpness
- Muscle twitches and cramps
- Swelling of feet and ankles
- Persistent pruritus
- Chest pain due to uremic pericarditis
- Shortness of breath due to pulmonary oedema from fluid overload
- Hypertension that is difficult to control
- Physical examination is often not helpful, but patients may present with:
 - > Skin pigmentation
 - > Scratch marks from pruritus
 - > Pericardial friction due to uraemic pericarditis
 - > Uraemic frost, where high levels of urea in sweat are observed
 - > Hypertensive fundal changes suggesting chronicity. These changes occur because of hypertensive retinopathy, which causes vascular constriction of retinal arterioles. Consequently, patients may present with typical fundus findings such as blot hemorrhages, hard exudates and cotton wool spots⁹

Oral health of patients with ESKD

Oral health is regarded as an important factor in determining the overall health outcomes in patients with ESKD. The burden of oral diseases is greater in ESKD patients than the general population, while increased mortality rates among ESKD patients are associated with dental conditions including caries, periodontitis, and poor oral hygiene.⁹ Cardiovascular events in ESKD may potentially be exacerbated by oral pathologies connected to systemic inflammation and malnutrition.⁹ Additionally, in the scenario of renal transplantation, threat of a dental infection is a potential risk for both organ transplant donors and recipients while dental disease is a pervasive condition that is more likely to be severe among renal transplant recipients.⁹

It has been estimated that 90% of chronic renal failure patients present with oral symptoms¹⁰ and that periodontitis affects 31.6% of adults with CKD stages 1–5 as well as 58% of patients in dialysis.⁹ ESKD patients, particularly those who are treated with dialysis, have poor quality of life, high levels of anxiety and depression, and a reduction of compliance towards oral health practices compared with the general population^{9,12}.

Oral manifestations

The oral cavity, being the window to the body, is generally the area where many systemic diseases initially present. As such, various oral tissues such as lips, tongue, gingiva, mucosal surfaces, dentition and alveolar bone may exhibit signs of such diseases. Some of the oral manifestations commonly observed in association with ESKD are:^{9,13}

- Ecchymoses, petechiae, and haemorrhage in the oral mucosa (Figure 1a)
- Xerostomia
- Halitosis called “uraemic fetor”
- Metallic taste due to high urea content in saliva
- Burning sensation of lips and tongue; uraemic stomatitis
- Angular cheilitis (Figure 1b)
- Accelerated destruction of periodontal tissues including periodontal pocket formation, gingival recession, and bone and tooth loss (Figure 1c)
- Dental caries
- Lichenoid lesions may arise associated with antihypertensive medication (Figure 1d)

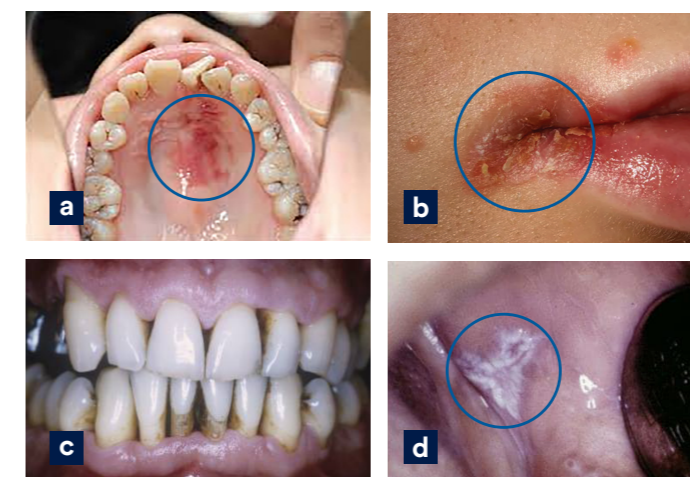


Figure 1: (a) Ecchymoses¹⁴; (b) Angular cheilitis¹⁵; (c) Accelerated periodontitis with gingival recession and tooth mobility¹⁶; (d) Lichenoid lesion¹⁷



Figure 2: Oral manifestations of renal osteodystrophy, arrows indicate radiolucent jaw lesions¹⁸

- Renal osteodystrophy (Figure 2): refers to defects occurring in the mineralised tissues of the oral cavity such as bones, enamel and dentine due to metabolism disorders of calcium, potassium and phosphorus that are associated with renal disorders.⁹ It may present as increased tooth mobility, malocclusion, pulp stones, enamel hypoplasia, bone demineralization, decreased trabeculation of cancellous bone, decreased thickness of cortical bone, radiolucent giant cell lesions and jaw fracture.

Treatment and Management Strategies

Patients with ESKD need special attention whilst undergoing dental treatments. Some of the clinical considerations are highlighted below^{9-11,13}

- Monitoring blood pressure during the procedures due to frequent hypertension
- Communication with the nephrologist is highly recommended
- Consideration of drug intolerance and increased susceptibility to infection

- Dental treatment with a risk of bleeding should be postponed to a non-dialysis day
- Local anaesthetics can be safely used because they are eliminated through the hepatic channel.
- Anti-inflammatory drugs such as ketoprofen, ibuprofen, or naproxen could cause hypertension and worsen the bleeding tendency
- Patients may require steroid supplementation prior to dental treatment to avoid an episode of adrenal crisis.
- All possible foci of infection and oral pathological lesions have to be intercepted.
- A strict follow-up program to maintain oral health and to evaluate periodontal health and healing on a three monthly, regular basis. Good oral health is one of the most important requirements to establish suitability for a kidney transplant, therefore a strict follow up schedule to monitor the oral health changes (if any) is essential.
- If a patient is on dialysis and intends to visit the dental professional for treatment following the dialysis, it is important to:
 - > Collect all information regarding medical history and medications
 - > Seek advice from a medical practitioner – it is recommended that people with kidney disease take antibiotics before receiving dental treatment because they are at increased risk of infections due to the presence of the shunt used for dialysis
 - > Gather information regarding location of the shunt before recording blood pressure to ensure that the blood pressure cuff is not placed on an arm or leg that contains the shunt.

Preventing dental disease

To avoid any serious dental issues, preventing and treating dental disease is vital. Preventing infections is also important when a patient is on a waitlist for kidney transplant, as an existing infection can preclude them from going ahead with a transplant. Good oral hygiene will remove bacteria that causes decay and gum disease. The following advice/recommendations will help maintain good oral health:

- Brush and floss regularly
- Use a fluoridated toothpaste to strengthen teeth against developing decay
- Regular use of mouth washes
- Patients may have xerostomia as a side effect of some medications used to treat kidney disease. To increase saliva and lubricate the mouth, you can recommend frequent sips of water, chewing sugarless gum or sucking on sugarless lollies.

- Emphasise the importance of regular dental check-ups to detect and treat decay and gum disease before they become serious.
- Patients wearing a full or partial denture should be advised to carefully clean their denture using a toothbrush or denture cleaning brush, morning and night. Dentures should be removed from the mouth at night and stored in a dry, safe location to prevent development of sore spots or ulcers.

Summary

ESKD has become a major public health problem globally, and often requires renal replacement therapy or kidney transplant. The number of patients needing a kidney transplant is growing, and as this patient group increases, their dental needs will also surge.

It is crucial to synchronise with the nephrologist and implement a dental treatment plan that takes into consideration the possible decline of the patient's general health condition pre- and post-dental treatment.

All issues related to kidney dysfunction need to be considered when treating these patients. Patients requiring transplantation need to be assigned to a strict follow-up program. Early detection of oral pathologies and strong preventive measures can minimise the need for extensive dental care. The involvement of the patient in the management of their oral health is central to increasing their motivation to maintain this. Dental practitioners have an important role to play in this regard.

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