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This article counts towards one of the five core subjects introduced in 2007 by the GDC.

Routine and Emergency Management Guidelines for the Dental Patient with Renal Disease and Kidney Transplant Part 1

Abstract: The number of kidney patients is increasing in all developed countries, mainly due to the increase in patients with type II diabetes. These patients may be asked by their renal physician to attend their general dental practitioner for an oral review prior to undergoing further renal treatment.

Dental surgeons working in the primary care setting will be required to manage patients who are at various stages of renal support, whether pre-dialysis patients with chronic kidney disease (CKD), dialysis patients, and also those who have had a kidney or kidney and pancreas transplant. In addition, dental practitioners may be faced with having to deal with the emergency management of such patients attending their practices in acute pain.

Clinical Relevance: This paper aims to provide the general dental practitioner with the necessary knowledge to manage renal patients, and outlines the guidance regarding the criteria for referral, work up procedure and dental management of such patients.

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An overview of the functions of the normal kidney

Kidneys filter the blood and, in so doing, remove the waste products of metabolism. It is important to appreciate the multiple functions that the kidneys normally carry out:[1]

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Excretion of metabolic waste products and foreign chemicals

Kidneys play a key role in eliminating the waste products of metabolism. They also remove most drugs and toxins. Blood levels of substances such as urea and creatinine can be used to assess the excretory functions of the kidneys. A better index of kidney function is achieved by calculating the eGFR (estimated Glomerular Filtration Rate). The normal value is 90–120 mL/min and lower values are used to classify the severity of kidney disease.

Early kidney dysfunction may be asymptomatic and, indeed, some patients only develop symptoms after significant damage has been done. Therefore, it is important to monitor urea and creatinine levels in high-risk patients, for example those with diabetes, hypertension, proteinuria, and recurrent urinary tract infections.

Kidneys are the major route of elimination for some drugs such as aminoglycosides and these can accumulate to toxic levels in patients with Chronic Kidney Disease (CKD).

Regulation of water and electrolyte balance

The kidneys regulate homeostasis. The levels of total body water, serum osmolality and electrolytes are kept within a narrow range by the kidneys. For example, kidneys have an enormous capacity to increase sodium excretion in response to an increased intake, and that explains why a high sodium intake leads to an elevated blood pressure (BP) in CKD patients.

Regulation of body fluid osmolality

Serum osmolality is maintained within a very narrow range of 275–290

mOsmol/l by the kidneys, mainly by regulating the water and electrolyte balance. Major determinants of osmolality are sodium, urea and glucose. A high osmolality, eg in dehydration, triggers the thirst mechanism so that water intake is increased until the osmolality is reverted to normal.

Regulation of arterial pressure

Kidneys play a pivotal role in BP control by altering the water and sodium balance and also by the Rennin-Angiotensin System (RAS). Many anti-hypertensives act on the RAS to normalize the BP in hypertensive patients, for example Angiotensin Converting Enzyme Inhibitors (ACE-I) and Angiotensin Receptor Blockers (ARBs).

Regulation of acid-base balance

Along with the lungs, the kidneys contribute to acid-base regulation by excreting acids. The kidneys are the only means of eliminating from the body certain types of acids, such as sulphuric acid and phosphoric acid, generated by the metabolism of proteins.

Hormone production and metabolism

Kidneys perform two important hormone functions – production of erythropoietin and conversion of vitamin D to its active form. Erythropoietin acts on the bone marrow and is a vital stimulus in the production of haemoglobin. This explains why the patients with advanced CKD are frequently anaemic. There are few exceptions, for example Adult Polycystic Kidney Disease (APKD) patients, who may not be anaemic despite CKD stage 5. This is because, in this condition, kidneys retain hormone production even though the

Stage/GFR (mL/min)	LA	Restorative Treatment	S&P	RCT	Extraction	Comments
Stage 1 GFR > 90	√	√	√	√	√	Usually no signs/symptoms of renal disease. No concerns regarding treatment.
Stage 2 GFR 60–99	√	√	√	√	√	Caution with patients who may have hypertension, or those prescribed antihypertensive medication.
Stage 3A GFR 45–59 Stage 3B GFR 30–44	√	Supragingival. Refer to SCD unless recent full blood count (FBC) known	Consider referral to SCD unless recent FBC known	Consider referral to SCD unless recent FBC known	Consider referral to SCD	Patient may be symptomatic. Nephrology advice should be sought. Decreased red blood cell (RBC) production. Will need liaison.
Stage 4 GFR 15–29	Refer to SCD	Refer to SCD	Refer to SCD	Refer to SCD	Refer to SCD	Discussion and preparation of dialysis may have been started at this stage. Will need work up and liaison for dental treatment. Uraemic platelet dysfunction – risk of bleeding
Stage 5 GFR < 15	Refer to SCD	Refer to SCD	Refer to SCD	Refer to SCD	Refer to SCD	Mostly symptomatic, eg lethargy, anorexia, dyspnoea, vomiting; thus indicating need for starting dialysis. Will need work up and liaison for dental care. Uraemic platelet dysfunction – risk of bleeding

√ :	Proceed with treatment
LA:	Local anaesthesia
SCD:	Specialist in Special Care Dentistry
S&P:	Scale and polish
RCT:	Root canal treatment

Table 1. Stages of CKD; and suggested treatment guidelines.

Figure 1. Arterio-venous fistula in a haemodialysis patient showing needle tracks along the vein.

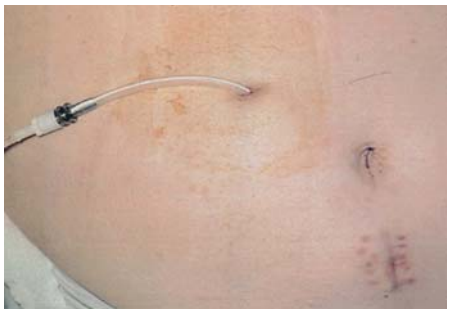

Figure 2. A Tenckhoff catheter used for peritoneal dialysis.

Oral Problems	Comment
Malodour/Uraemic halitosis/ Dysgeusia	Uraemic halitosis may be indication for dialysis
Calculus/Periodontal disease	Increased risk of periodontitis in renal patients
Mucosal lesions	Seen in neutropenia, eg after cyclophosphamide chemotherapy for vasculitis
Xerostomia	Reduced/restricted fluid intake, especially if on haemodialysis
Gingival bleeding	Decrease in platelets adhesion and aggregation (seen in advanced uraemia)
Pale gingivae	Renal anaemia
Loss of lamina dura, abnormal bone remodelling; Maxilla/mandibular radiolucent lesions	Hyperphosphataemia and hyperparathyroidism
Tooth mobility	Altered bone metabolism
Lichenoid areas	Associated drug therapies, eg diuretics, beta blockers

Table 2. Oral manifestations of chronic kidney disease.

excretory function is lost.

With Acute Kidney Injury (AKI) or in CKD, there is major disruption of these homeostatic mechanisms. This results in varying degrees of abnormalities in the body fluid balance and, in severe cases, may lead to pulmonary oedema, hyperkalaemia, and enough retention of waste products to cause coma and death within a few days. Life-saving interventions, for example dialysis, are required in such circumstances to restore the body systems, at least partially, and to stabilize the patient until more definitive measures, such as kidney transplantation, can be undertaken.

Chronic kidney disease

Chronic kidney disease (CKD) is defined as kidney damage or glomerular filtration rate (GFR) <60mL/min/1.73m^2 for 3 months or more.[2] Diabetes and hypertension are the most common causes. Less common aetiologies include hereditary disorders such as polycystic kidney disease, malformations of the urinary tract and glomerulonephritis. Regardless of its cause, CKD leads to a progressive loss of excretory and endocrine function of the kidney with subsequent hypertension, retention of nitrogenous waste, anaemia (mainly due to loss of erythropoietin secretion) and disturbed calcium-phosphate-vitamin D metabolism. The KDOQI (Kidney Disease Outcomes Quality Initiative) has categorized renal failure into six stages of severity (Table 1). Nephrology teams are usually involved in patients' care during CKD stage 3 and beyond. Amongst all causes of CKD, diabetes mellitus has one of the fastest rates of decline in GFR, averaging up to 10 mL/min/year (signifying up to 10% decline in kidney function annually). Sudden deterioration can also occur due to dehydration or use of nephrotoxic drugs. On a worldwide basis, the number of patients with End-Stage Renal Disease (ESRD – also called CKD stage 5) increases by 5% annually. In 2010, there were more than 2 million patients with ESRD worldwide with an estimated treatment cost of £1 trillion.[3]

Renal replacement can be by transplantation, haemodialysis (HD) and peritoneal dialysis (PD). HD is usually performed in health centres or hospitals and necessitates an arterio-venous access (Figure 1). Blood flows from the access into the dialysis machine and through a filter that removes excess fluid and uraemic solutes. PD is performed at home, either by the patient or by a suitably trained carer. A PD catheter (Figure 2) is placed in the peritoneal cavity and a dialysis fluid is exchanged at regular intervals.

The changing age and survival demographics of renal patients mean that the dental practitioner will come across an increasing number of renal patients, and a significant proportion of them will be in the older age group. In addition, the dental practitioner may be required to provide oral care for more complex cases, including those with renal transplants who are usually on multiple medications, including

the immunosuppressives. There are many policies and protocols on managing such patients, and this article is written with a view to providing an updated and concise approach that may be helpful in tailoring local protocols.

Oral manifestations in chronic kidney disease

CKD can give rise to a variety of oral manifestations. Enamel hypoplasia is amongst the early signs and is particularly common in children with chronic renal failure.[4] Metabolic acidosis appears to be particularly detrimental to the formation of enamel.[5] A reduced incidence of childhood caries has been demonstrated in renal patients, possibly because of the inhibitory effects of increased salivary urea.[6] Nausea, vomiting or gastro-oesophageal reflux are common in CKD and also cause erosion of enamel.

Uraemic halitosis, although uncommon, is a classical feature of end-stage renal failure that usually prompts the nephrologist to consider the initiation of dialysis, even if there are few other symptoms. Uraemic halitosis is usually described as an ammonia-like[7] odour, which can also be present in 25–30% patients on HD.[8] Altered taste sensation is a prominent symptom and may contribute to decreased appetite. Uraemic stomatitis can manifest as white, red or grey areas of the oral mucosa. Erythemo-pultaceous and ulcerative forms have been described as well.[9,10] Other oral lesions in renal patients include lichen planus, fibro-epithelial polyps, pyogenic granuloma and papilloma.[11] An overview of oral manifestations seen in chronic kidney disease is presented in Table 2.

Renal bone disease is another feature of chronic renal failure. This disorder is characterized by reduced vitamin D levels, phosphate accumulation and hyperparathyroidism. However, it rarely affects the mandible or maxilla.[11] There may be abnormal bone repair and healing after dental extractions, causing osteonecrosis in severe cases. Osteoporosis is also not uncommon in renal patients, although it is difficult to distinguish from renal bone disease. Drugs used in this condition include the bisphosphonates, which are now known to cause osteochemonecrosis – a rare but refractory and disfiguring complication.[12] This seems to be more commonly associated with the administration of high-dose intravenous bisphosphonate treatment in oncology patients and is thus less common in renal patients. Any dental treatment should therefore be completed prior to bisphosphonate therapy.[13,14]

Figure 3. Granulomatous lesions in a patient with Wegener's granulomatosis. (Courtesy of Dr Ursula Goebel, Charite Hospitals, Berlin, Germany).

Figure 4. Erosion of palate in a patient with ANCA vasculitis.

Figure 5. Vasculitic skin lesions.

Figure 6. Mucosal discoid lupus in a patient with SLE. (Courtesy of Prof Marion Haubitz, Hannover Medical School, Hannover, Germany).

Some specific renal disorders are associated with particular intra-oral manifestations. They may even precede the development of systemic signs and symptoms. For example, in ANCA (Anti-Neutrophil Cytoplasmic Antibodies) associated vasculitis, the patient may seek dental advice with intra-oral lesions of varying severity, sometimes even before the systemic effects are manifest (Figures 3 and 4). Vasculitic skin lesions can be suggestive of an ongoing systemic process (Figure 5). Similarly, oral ulcers are a common and often early manifestation of Systemic Lupus Erythematosus (Figure 6). Underlying autoimmune disorders should be kept in mind whenever patients present to the dental team with such symptoms. Tables 2 and 3 provide an overview of specific intra-oral manifestations of renal disorders.

In the UK, it would be unusual for the dental practitioner to come across a patient who has advanced undiagnosed kidney disease, but the following features may point towards a renal problem:

- High blood pressure;
- Prolonged bleeding following a minor dental procedure;
- Anaemia;
- Enamel erosion;
- Xerostomia.

Guidance for the general dental practitioner

Assessment

It is important to highlight that acute and primary care trusts and dental practices may have their own local protocols for managing renal and transplant patients. This paper provides guidance, which may be incorporated into the local protocols.

If there are concerns regarding a patient's oral health, and particularly if the patient is being considered for either dialysis or renal transplant, the general dental practitioner may be called upon by the renal physician. In such instances, a thorough oral and radiographic examination should be an essential part of the patient assessment.

A detailed medical history should be taken. Table 4 outlines specific

Disease	Renal Disease	Oral Manifestations
Sjögren's syndrome	Auto-immune disease with auto-antibodies; chronic interstitial nephritis	Xerostomia and increased caries
Scleroderma	Multi-system disease with renal failure and poor prognosis	Microstomia, shortened lingual frenulum
Osteonecrosis of the jaw due to bisphosphonates or altered bone metabolism	Often patients with plasma cell dyscrasias (multiple myeloma)	Rare but potentially dangerous and disfiguring side-effect of bisphosphonates; conservative management preferred but surgical intervention may be necessary
Granulomatous ANCA-associated vasculitis (Wegener's granulomatosis)	Systemic vasculitis with or without renal involvement	Gingival involvement ('strawberry gums') and/or ulceration
Systemic lupus erythematosus (SLE)	Systemic disease with anti-nuclear antibodies with or without renal involvement	Oral ulceration Lichenoid reactions Ulceration
Amyloidosis	Systemic disease due to plasma cell disorders (AL amyloidosis), long-standing systemic inflammation (AA amyloidosis) or long-term dialysis	Tongue enlargement

Table 3. Renal disease with specific oral manifestations.

information that would help the dentist in identifying any possible complications, and in planning the dental treatment. This information should form an integral part of a patient's dental record.

What dental treatment can be safely performed in general dental practice?

Many patients with early renal failure are treated successfully in general dental practice. All relevant medical details should be available and, if the patient is otherwise fit and well, routine dental treatment may be undertaken following recommendations of the patients' renal physician and the suggested guidance in Table 1.

The main concerns for the general dental practitioner are issues of bleeding, infection and drug interactions, toxicity and dosage. A significant event in the course of renal disease is when a patient is classified as stage 3 CKD. It is at this point that further work up may be required to ensure safety of the patient when undergoing certain dental procedures.

Some renal patients may be prescribed warfarin. Evidence-based dentistry states that minor surgical procedures can be safely carried out without adjustment to the warfarin dosage as long as the INR is less than 4.[15,16]

Preventive advice and treatment

It is extremely important that the patient receives appropriate preventive advice. Sodium fluoride toothpaste (5000 ppm) should be prescribed in all renal patients.[17] Salivary substitutes, such as *BioXtra* oral gel (Lifestream Pharma NV, Belgium) can be helpful for those suffering from xerostomia. To improve oral hygiene, chlorhexidine gluconate rinse (0.2%) or gel (1%) can be prescribed. In patients complaining of oral pain or discomfort, benzydamine hydrochloride 0.15% may provide symptomatic relief.

Emergency dental care

When a patient with renal disease attends a dental practice because of pain, it is essential to undertake an initial assessment (Table 4). For patients in stage 4 or 5 CKD, or those on dialysis, advice may be sought from the renal physician or the general medical practitioner. Additional help can be requested from the local Specialist in Special Care Dentistry.

When dealing with facial swelling and sepsis, doses of antibiotics should be adjusted according to the renal function. Dose adjustment for commonly prescribed antibiotics is given in Table 4 in Paper 2 of this two-part series. For dental procedures in patients with advanced renal failure, erythromycin is the antibiotic of choice – unless otherwise contra-indicated. Drainage of pus through the tooth should be obtained if possible.

Paracetamol can be safely prescribed to relieve dental pain. However, non-steroidal anti-inflammatory drugs (NSAIDs) and COX-2 inhibitors must be avoided in pre-dialysis and transplant patients. It is of utmost importance to consider drug interactions with immunosuppressives when prescribing for transplant patients. Even the slightest doubt should prompt consultation with the nephrologist.

Bleeding from the gingival tissue or extraction site can usually be managed by local measures, for example pressure, haemostatic gauze, horizontal mattress suture, local anaesthetic such as lignocaine (2%) with adrenaline (1:80000) or citanest (3% prilocaine) with octopressin.

The elective extirpation of pulp tissue should be delayed until advice from the renal physician has been received.

Conclusion

Patients with renal disease may have related oral signs and symptoms and in some cases may be presenting with features of a multi-system disorder involving the kidneys. Dental treatment may seem a low priority for patients with CKD and problems only come to light when patients undergo work up for renal transplant. General dental practitioners may be reluctant to provide oral care for patients on dialysis or those with a renal transplant. This paper outlines information to help practitioners provide care safely in practice, and provides guidance as to when they should refer the patient to a Specialist in Special Care Dentistry. The awareness regarding drug interactions is particularly important in transplant patients and there should be a low threshold for seeking advice from renal physicians if the dental practitioner has any concerns.

Question
Stage of renal disease if known
Has physician suggested dialysis in near future?
Is the patient on dialysis?
Type of dialysis:
Frequency:
Days of dialysis:
Last haemodialysis on:
Is patient on a diet/fluid restriction?
Has patient undergone renal transplant?
Drug allergies?
Medications:
Is Aspirin, clopidogrel, or warfarin in the medication list?
Is the patient on any immunosuppressives?
Does current level of renal disease impact significantly the patient's life?
Name of renal physician to contact for advice if required?

Table 4. Initial assessment of dental patient with renal disease.

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CPD ANSWERS

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1. A, C, D
2. B, D
3. A, B, D
4. B, C, D
5. A, B
6. A, B, C
7. A, B, C
8. A, D
9. B, C
10. A, B, D