

CRITICAL ISSUES IN DENTAL HYGIENE

A Comprehensive Oral Preventive Care Protocol for Caring for the Renal Transplant Population

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Abstract

Purpose: Candidates and recipients of kidney transplants are at high risk for oral infections due to systemic co-morbidities, and disease and drug-induced immunosuppression. Developing oral infections while on the waiting list can jeopardize candidacy for receiving a kidney, and post-operatively increases the chance for organ rejection. Therefore, it is imperative to minimize oral disease risks in this population. A comprehensive, oral preventive care protocol is presented to guide dental professionals with patient management throughout the process of care. Proper dental and dental hygiene care can help to prevent oral infections, optimize oral health, and enhance overall health and quality of life for the renal transplant population.

Keywords: kidney transplant, oral care protocol, oral infections, process of care

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists use emerging science to reduce risk in susceptible patients (risk reduction strategies).

INTRODUCTION

Currently, there are approximately 96,000 people in the U.S. waiting for a kidney transplant.¹ The waiting list is long because there are limited renal donors, and dialysis prolongs the lives of individuals with end stage renal disease (ESRD) allowing patients to wait a longer period of time before an organ becomes available. The waiting period for a kidney ranges from 5 to 10 years depending upon the state in which the transplant will take place. In spite of the odds, a renal transplant is the preferred treatment for patients with ESRD.^{2,3}

Patients with ESRD are at high risk for oral infections due to use of immunosuppressants and from complications related to comorbidities and/or from secondary developing medical conditions. These conditions include diabetes mellitus, hypertension, chronic glomerulonephritis, systemic lupus erythematosus, anemia and hyperparathyroidism, all of which may compromise both oral and overall health and longevity.^{1,4,5} Therefore, to provide safe, high-quality care to candidates and recipients of a kidney transplant, it is critical for dental and medical providers to be current in the best oral care practices for managing this population.³

A dental hygienist's knowledge and expertise in oral health can be beneficial to prepare, educate and support the oral health of the patient before, during and after transplantation, and to help ensure long-term organ success. A comprehensive, standardized oral care preventive protocol for use with renal transplant candidates and recipients was developed to guide dental professionals with decision-making throughout the process of care. Preventive care is essential to minimize and/or prevent oral infections, which may

decrease risk of organ rejection and enhance overall health and quality of life.

There are recommendations in the literature that can be used as guidelines to follow when treating kidney, and other transplant populations.^{2,3,6-10} However, these recommendations lack consistency, and currently, there is no comprehensive dental care protocol in place that focuses on prevention.^{2,3,11} Further, dental care protocols can vary across institutions, as well as within a given hospital center according to the type of organ being transplanted.^{2,3,9,12,13} Dental professionals will benefit from having a comprehensive oral care protocol that is specific to renal transplant patients that can be used as a guide to help optimize patient care outcomes.

Use of an oral care preventive protocol for this patient population also provides the foundation for a well-informed collaboration between dental and medical providers. Dental professionals will understand what information is needed from the medical team for use with treatment planning to ensure the safe provision of quality oral health care. Following a protocol also may help to reduce patient mismanagement due to lack of adequate knowledge, training and experience with treating this medically-complex population. More dental professionals will encounter patients who are either awaiting renal transplant or who have received a transplant due to end-stage renal disease associated with diabetes.

During the pre-transplantation period, it is recommended that dental professionals consult with the pa-

Table I: Pharmacological Considerations for Managing Patients With End-Stage Renal Failure^{4,5,14}

Drug	Type	Dosage Adjustment (End-stage renal failure – GFR <10 mL/min)	Range of Dosage
Analgesics/ Anti-inflammatory	Acetaminophen	GFR <10 mL/minute/1.73 m ² : Administer every 8 hours	325 to 650 mg
	Aspirin	Avoid	-
	Ibuprofen	Avoid	-
	Naproxen	Avoid	-
Anesthetics	Lidocaine (Xylocaine)	No adjustment required	N/A
	Mepivacaine	No adjustment required	N/A
Antimicrobials	Amoxicillin	Use with caution in patients with renal impairment; dosage adjustment recommended. In addition, use of certain dosage forms (eg, extended release 775 mg tablet and immediate release 875 mg tablet) should be avoided in patients with CrCl <30 mL/minute or in patients requiring hemodialysis.	250 to 500 mg
	Cephalexin	Administer every 12 to 24 hours (dialyzable 20%-50%); give dose after dialysis; if CrCl <10 mL/min, give 250 to 500 mg every 12 to 24 hours	250 to 500 mg
	Clindamycin	No adjustment required	N/A
	Azithromycin	Use with caution in patients with renal impairment (GFR <10 mL/min); administer 250 to 600 mg once daily or 1 to 2 g as a single use; no supplemental dosage required. In addition, use of 2 g as a single dose for the extended release suspension (Zmax)	250 to 600 mg or 1 to 2 g

tient's nephrologist prior to initiating any dental treatment to determine medical stability and the need for treatment modifications, such as antibiotic prophylaxis, corticosteroid supplementation and/or erythropoietin replacement therapy.^{2,3,5,6,8-10} Contraindications for use of dental-related medications that are metabolized and excreted by the kidneys should be addressed. These medications include, but are not limited to, anti-inflammatory drugs, analgesics and some opioids (Table I). In addition, renal function values should be obtained to determine the need for dosage adjustment for drugs used during dental procedures (Table II).^{2-5,8-10} Other relevant laboratory values needed to assess risk for infection and bleeding include complete blood cell count (CBC), absolute neutrophil count (ANC), and platelet count (Table II).^{2,4,8-10}

Oral health professionals should examine the patient to detect any signs of oral pathology, infection and acute and/or chronic inflammation. Any active dental disease should be eliminated, non-elective restorative and periodontal work should be completed, faulty dental appliances should be adjusted, and thorough oral hygiene education should be given to the patient to avoid possible infections.^{2,3,9} It is also important that

dental professionals maintain communication with the treating nephrologist and transplant team before and after the transplant procedure so that the patient's oral health can be properly monitored, as poor oral health increases risk for systemic complications.

Transplant recipients are placed on immunosuppressant therapy to prevent organ rejection. Patients are typically managed with a combination of multiple immunosuppressants, which may include cyclosporine, azathioprine, mycophenolate, tacrolimus and prednisone.^{2,3,6,14} These medications suppress the host immune system, producing a chronic inflammatory response to bacterial plaque biofilm. Gingival enlargement, though most commonly observed with cyclosporine, also has been shown to occur in patients taking tacrolimus.¹⁵

Oral candidiasis and herpes simplex virus are other common oral infections in recipients of renal transplants, especially immediately after transplantation, which can lead to systemic infections.^{2,3,6,12,16} In particular, Candida infections are linked to bloodstream, esophagus, and other organ infections. A previous study showed that prevalence of oral candidiasis in pa-

Table II: Laboratory Screening Tests for Dental Treatment Modifications for Renal Patients^{4,5,8,10,20}

Test	Normal Range	Abnormal Range Affecting Dental Treatment (End-stage renal failure)
Creatinine clearance	85 to 125 mL/min (women)	<10 mL/min (dialysis) requires drug dosing modification
	97 to 140 mL/min (men)	
Glomerular filtration rate (GFR)	100 to 150 mL	<10 mL/min (dialysis) requires drug dosing modification
Complete blood count (CBC) with differentials	White CBC: 4,400 to 1,000/mL	Leukopenia <4,000/mL When WBC count <2,000 cells/mL, increased risk of systemic infection: antibiotic prophylaxis is recommended.
	Platelet count: 150,000 to 450,000/ μ L	Significant bleeding risk when the platelet count <60,000/ μ L
	Absolute neutrophil count (ANC): 1,500 to 7,200 cells/mL	<1,500 cells/mL When ANC <500 cells/ml, increased risk of systemic infection: antibiotic prophylaxis is recommended.

tients with renal transplants ranged from 7.7 to 46.7% as compared to healthy controls.^{16,17}

Research supports a relationship between oral disease and malnutrition.¹⁸ Candidates for renal transplants should adhere to a restricted diet, which limits sodium and fluid intake. This diet can promote dry mouth and the resultant loss of natural antibacterial, antiviral and antifungal properties of saliva. The loss of protective salivary immunoglobulins increases risk for caries, gingival disease, herpetic lesions and fungal infections. Patients also may experience increased trauma due to the decreased amount of saliva lubricating the oral mucosa.^{2,3,19} A dental hygienist has expertise to guide treatment decisions and recommendations on various oral care products that can reduce oral disease risks and improve comfort and function.

The purpose of this short report is to disseminate a new comprehensive oral care protocol created to assist oral health professionals with proper assessment, management and maintenance steps that are essential to safely care for candidates for and recipients of a renal transplant. Dental hygiene actions associated with each phase of the process of care are illustrated in Figure 1, located at the end of this manuscript.

DISCUSSION

A comprehensive oral care preventive protocol identifies special considerations and provides clear guidance for tailoring a treatment plan for candidates for and recipients of a kidney transplant. Use of this protocol will help dental care providers to adequately address the complexity of diseases, oral conditions and medications that are commonly encountered in pre- and post-renal transplant. When these considerations are addressed for this population, oral infections that can jeopardize candidacy for and longevity of renal transplants can be minimized or prevented.

A comprehensive, oral care preventive protocol is now available to help guide decision-making throughout the process of care when treating the renal transplant population. Use of this evidence-based protocol supports best practices by dental professionals so that they can safely care for this growing medically-complex population. Optimizing oral health helps to ensure candidacy while awaiting renal transplant, decreases risk of organ rejection post-transplant, and enhances overall health and quality of life.

CONCLUSION

Collaboration between medical and dental care providers is critical while caring for candidates for and recipients of a kidney transplant. This oral care preventive protocol provides a framework that addresses special considerations pertaining to this specific transplant population. Dental professionals are encouraged to use this protocol as a checklist while caring for patients with end-stage renal disease and post-transplant. Further, dental professionals may use this protocol to initiate collaboration with medical providers, encourage discussion with the patient, and the planning and delivery of comprehensive oral care. Research is needed to assess the impact of use of this protocol on patient outcomes.

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Figure 1: Dental and Dental Hygiene Actions According To the Process of Care

Assessment	Special Considerations
Health Risks	
Identify and document medical diagnoses and status including comorbidities, stability and risk factors for medical complications	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Determine level of risk for systemic complications due to pre-existing comorbidities and/or from secondary developing medical conditions (e.g. diabetes mellitus (DM), hypertension (HTN), congestive heart failure, chronic glomerulonephritis, systemic lupus erythematosus (SLE), polycystic disease, anemia, hyperparathyroidism)^{2-7,21} • Document the reason for renal failure • Post-Transplant: Higher incidence of viral infections due to immunosuppression (e.g. herpes simplex virus (HSV), cytomegalovirus (CMV), Epstein-Barr virus (EBV), hepatitis B and C (HBV and HCV), and human immunodeficiency virus (HIV))^{2,22} • Other side effects of immunosuppressive agents are major complications that cause higher susceptibility to bacterial and fungal infections, poor wound healing, excessive bleeding, Cushingoid reaction, Addison's reaction, tumors and osteoporosis^{4,14} • Note that anemia post-transplantation remains a concern for patients with chronic renal disease²³
List medications and their usage (match with patient's existing medical diagnoses and comorbidities)	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Assess systemic/oral side effects of the medications • Post-Transplant: Cyclosporine, a common immunosuppressive agent used to prevent rejection of the transplanted organ may cause major changes in the kidney that can lead to hypertension, bleeding problems, and anemia³ • Use of prednisone can cause hypertension, diabetes mellitus, impaired healing, and increased risk for infection^{2,14,24} • Corticosteroid use and persistent hyperparathyroidism can be contributing factors for osteoporosis and bone loss²⁴
Identify type and frequency of dialysis	<ul style="list-style-type: none"> • Pre-Transplant: Recommend dental treatment one day after hemodialysis because of heparin use during treatment and potential complications with hemostasis⁴
Identify date of planned transplant surgery (if known)	<ul style="list-style-type: none"> • Pre-Transplant: Identify timeline to reach either acceptable or optimal oral health
Date of transplant surgery and type of kidney donor	<ul style="list-style-type: none"> • Post-Transplant: Document type of kidney patient received: deceased or living donor
Determine need for medical consultation with nephrologist and identify pertinent questions involving dental treatment <ul style="list-style-type: none"> • Need for antibiotic prophylaxis • Laboratory reports for renal function and other comorbidities • Dental Procedure: bleeding & bacteremia concerns • Medication considerations: anticoagulants, immunosuppressants, antihypertensives, oral hypoglycemics, diuretics • Contraindications to dental treatment • Systemic comorbidities that complicate/contraindicate dental treatment 	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Consult the patient's nephrologist prior to initiating any dental treatment to determine medical stability and the need for precautions, such as antibiotic prophylaxis, corticosteroid supplementation and/or erythropoietin replacement therapy^{2,3,5,6,8,10,12} • Post-Transplant: Six months may be required before renal organ transplant recipients are deemed stable enough to receive dental treatment; therefore, no elective dental treatment should be performed during this timeframe unless it is a dental emergency^{2,6}

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

<p>Review laboratory values to ensure that the patient is stable to treat (white blood cell count (WBC), absolute neutrophil count (ANC), platelet count)</p>	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Determine whether the patient has an adequate white cell count to prevent post-dental treatment infections. Assess risks for bleeding, including platelet count, to ensure that the patient can be managed safely during treatment. For guidance on treatable laboratory values, refer to Table II • Request recent/new laboratory values when planning to perform any invasive dental procedures • Post-Transplant: WBC, ANC, and platelet count should be done every 6 months during the first year post-transplant and annually thereafter^{2,23}
<p>Determine the need for dosage adjustment of medications commonly used for dental pain management and treatment of oral infections</p>	<ul style="list-style-type: none"> • Determine drug dosage adjustment required for medications used during dental procedures according to renal function values (glomerular filtration rate (GFR) and creatinine clearance) • Identify contraindications for use of commonly prescribed medications that are metabolized and excreted by the kidneys (some antibiotics, anti-inflammatory drugs, analgesics, and some opioids) • Refer to Table I
<p>Assess psychosocial health</p>	<ul style="list-style-type: none"> • Assess patient's risk behaviors: Alcohol, tobacco and/or recreational drug use • Assess presence of psychiatric conditions (e.g. anxiety, depression)
<p>Identify risk factors for oral infections and oral complications</p>	<ul style="list-style-type: none"> • Pre-Transplant: Determine level of risk for oral infections and oral complications due to medical condition, pre-existing comorbidities and/or from secondary developing medical conditions prior to renal transplantation (DM, HTN, chronic glomerulonephritis, SLE and other factors) and from medications (e.g. reduced salivary flow) • Post-Transplant: Note higher incidence of new onset DM, which is common in the first year post-transplantation²⁵ • Note higher incidence of oral manifestations due to side effects of over-immunosuppression, use of immunosuppressive agents and/or chronic rejection² • Note that any infection is a serious concern as it may lead to organ rejection • Immediately refer patient to treating nephrologist and/or dentist if oral complications are observed
<p>Vital signs</p>	
<p>Ensure values are within treatable range</p>	<ul style="list-style-type: none"> • According to recent evidence-based guidelines for the management of high blood pressure from JNC8, the blood pressure goal should be below 140/90 mmHg for patients with chronic kidney disease²⁶ • Blood pressure is considered uncontrolled when $\geq 180/110$ mmHg - elective dental care should be deferred and immediate referral for evaluation and treatment is recommended²⁷ • Pre-Transplant: As renal function decreases, likelihood of hypertension increases - monitor blood pressure before and during dental treatment due to high incidence of hypertension^{4,5} • Refer patient to treating nephrologist if blood pressure is elevated • Avoid taking blood pressure on arm where arteriovenous shunt is placed in patients receiving hemodialysis⁴ • Post-Transplant: Note that patients taking cyclosporine and prednisone can have elevated blood pressure²

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

Radiographic Examination	
Presence/absence of pathology	<ul style="list-style-type: none"> • Pre-Transplant: Monitor and assess the need to treat oral conditions that were apparent on previous radiographs and diagnosed prior to renal transplantation • Assess radiographs for osteodystrophy causing jaw bone alterations and demineralization and increasing risk for tooth mobility, giant cell lesions, and fracture (risk for fracture while performing dental treatment, especially extractions) • Assess narrowing of the pulp chamber in teeth as a side effect of impaired calcium and phosphate metabolism²² • Pediatric considerations: Assess for enamel hypoplasia, which may result from interference in calcium and phosphate metabolism and/or long-term corticosteroid use^{22,28}
Extra-oral and Intra-oral Head and Neck Examination	
Assess the patient for the following conditions:	
Bacterial, viral (herpes simplex) and fungal infections (candidiasis)	<ul style="list-style-type: none"> • Pre-Transplant: Identify and treat oral infections that can jeopardize candidacy for receiving a kidney should a donor become available¹² • Post-Transplant: Identify and treat oral infections that can jeopardize long-term success of renal transplant • Identify and treat oral conditions associated with over-immunosuppression, side effects of immunosuppressants and/or chronic rejection^{2-4,6,8,16,17,22}
Petechiae, gingival bleeding	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Note high risk of excessive gingival bleeding due to thrombocytopenia, infection, medication usage and use of anticoagulants such as heparin^{2,4}
Reduced salivary flow	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Note increased risk for caries, gingival disease, herpetic lesions and fungal infections due to loss of protective salivary immunoglobulins and lubrication • Assess patient for signs of oral discomfort and dryness associated with diminished salivary flow^{2,5,21,22,29}
Gingival hyperplasia	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Assess presence of gingival hyperplasia associated with use of calcium channel blockers, poor oral hygiene • Post-Transplant: Assess presence of gingival hyperplasia associated with use of immunosuppressants such as cyclosporine^{3,10,22}
Ulcerations	<ul style="list-style-type: none"> • Pre- and Post-Transplant: Assess for presence of disease and/or drug-induced ulcerations
Uremic stomatitis	<ul style="list-style-type: none"> • Pre-Transplant: Assess mucosa for a red appearance that later can become ulcerative; patient may report burning sensation (Four types: erythemo-pultaceous, ulcerative, hemorrhagic and hyperkeratotic)^{8,22}
Red-orange discoloration of the cheeks and mucosa	<ul style="list-style-type: none"> • Pre-Transplant: Assess for carotene-like pigments that appears when renal filtration is decreased^{2,22}
Metallic taste	<ul style="list-style-type: none"> • Pre-Transplant: Ask patient about metallic taste associated with high concentrations of urea in the saliva^{5,8,22}
Pallor of the mucosa	<ul style="list-style-type: none"> • Pre-Transplant: Examine the mucosa for pale appearance due to anemia
Precancerous/cancerous lesions	<ul style="list-style-type: none"> • Post-Transplant: Note higher incidence of squamous cell lip carcinoma and Kaposi's sarcoma due to immunosuppression^{2,22}

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

Periodontal and Dental Examination	
Acute/chronic signs of infection or inflammation (e.g. periodontal or endodontic abscesses, dental caries, periodontitis)	<ul style="list-style-type: none"> • Pre-Transplant: Identify and treat oral infections that can jeopardize candidacy for receiving a kidney should a donor become available • Note high incidence of attachment loss due to poor oral hygiene, and dental calculus formation due to uremic status and duration of renal disease^{3,11,21,28} • Address any active acute/chronic oral infections prior to clearance for transplantation • Post-Transplantation: Address any active acute/chronic oral infections and inflammation as soon as possible due to systemic immunosuppression which can increase risk for kidney dysfunction¹⁰
Assess for dental erosion of lingual surfaces	<ul style="list-style-type: none"> • Pre-Transplant: Observe that enamel erosion is commonly associated with regurgitation and vomiting from high levels of uremia^{4,5,22}
Pediatric dental considerations	<ul style="list-style-type: none"> • Pre-Transplant: Red-brown discoloration can be observed on developing teeth as well as delayed tooth eruption • High levels of uremia decrease incidence of dental decay by minimizing end by-products of bacterial plaque, especially in children^{8,11,21,28}
Oral Hygiene Assessment	
<ul style="list-style-type: none"> • Assess oral hygiene status and risk factors for oral disease • Assess oral health knowledge and values • Assess physical and cognitive ability to maintain optimal oral health • Assess tobacco use and other habitual behaviors 	<ul style="list-style-type: none"> • Assess level of biofilm • Assess need for oral health education to promote knowledge and value for oral health in relation to systemic health status • Assess dexterity • Encourage cessation of tobacco use and other behaviors that are detrimental to oral and systemic health
Nutritional Assessment	
Assess nutritional status and indications for fluid restrictions	<ul style="list-style-type: none"> • Pre-Transplant: Note that dietary restrictions which limit sodium and fluid intake can promote dry mouth, and result in loss of natural antibacterial, antiviral, and antifungal properties of saliva^{3-5,8,22} • Consult with the patient's dietician about the impact of food choices on oral health status • Post-Transplant: Note fewer dietary restrictions in post-transplantation period

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

Planning	
Preventive Care Plan	
Develop a plan of prevention to minimize oral infections pre- and post-renal transplantation	<ul style="list-style-type: none"> • Caries: Determine the need for fluoride therapy, including type, strength and frequency of use based on risk factors for caries (xerostomia, diet, medications, other) • Systemic fluoride supplements are contraindicated in patients with chronic renal insufficiency and failure¹⁴ • Recommend xylitol containing products. Dosage frequency should be a at least 2 times per day and not exceed 8 grams per day^{30,31} • High dosages of oral xylitol can cause gastrointestinal discomfort and/or diarrhea when exceeding 40 to 50 grams per day¹⁴ • There is insufficient evidence to support safety of use of remineralization products containing phosphate and calcium; caution is advised with use due to altered metabolism of these substances in patients with renal disease • Soft tissues: Prevent medication-induced complications that increase risk for infection; determine the benefits of using palliative agents to manage complications and discomfort associated with dry mouth and oral ulcerations • Salivary stimulants: Use of a sonic toothbrush may mechanically stimulate salivary flow in some users³² • Salivary Substitutes (moisturizing agents): Look for products that are alcohol-free, contain xylitol, contain carboxymethylcellulose or hydroxyethyl cellulose, such as oral mouthrinses, oral sprays, gels, lozenges or pastilles • Prevention of fungal infections: Twice daily use of antimicrobial mouthrinses with essential oils or 0.12% chlorhexidine gluconate show efficacy against fungal organisms and may be beneficial to reduce risk for fungal infections³³⁻³⁵ • Periodontal: Prevention of acute periodontal infections and management of chronic periodontal conditions can be achieved by reducing biofilm level through use of therapeutic antimicrobial mouthrinses and therapeutic dentifrices • Biofilm: Evaluate patient's manual dexterity and ability to remove dental biofilm effectively in his/her mouth; determining the patient's manual dexterity will enable the dental professional to recommend optimal oral hygiene aids for use with oral self-care • Mechanical: Review interdental and toothbrushing techniques for biofilm removal and recommend appropriate devices (interdental cleaning, irrigation devices, soft or extra-soft manual toothbrushes); evaluate benefits of using a power toothbrush; Remind the patient to replace toothbrush at least every 3 months or sooner if oral infection or sickness occurs (e.g. cold); recommend tongue cleaning • Chemical: Recommend use of antimicrobial mouthrinses (essential oils, cetylpyridinium chloride, 0.12% chlorhexidine gluconate) and/or a therapeutic dentifrice (triclosan, stannous fluoride) to reduce oral biofilm and to promote a healthy oral ecosystem^{2-4,19}
Treatment Planning	
Develop a patient-centered dental hygiene care plan <ul style="list-style-type: none"> • To treat existing oral infections/disease • To stabilize oral health during pre- and post-transplant stages 	<ul style="list-style-type: none"> • Care must be taken to understand the limitations of the patient's abilities, time and access to proper tools, given that the patient may be overburdened by medical and financial concerns, as well as the time demands of undergoing dialysis and medical treatment

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

Educate the patient about his/her systemic condition and the relationship to oral health	<ul style="list-style-type: none"> • Pre-Transplant: Discuss that early detection of oral complications and timely interventions are critical to reduce systemic threats that could jeopardize candidacy for transplant • Post-Transplant: Emphasize that infections are a serious concern due to risk for possible organ rejection
Set number of dental hygiene visits, sequencing and type of appointment, including time requirement for each visit (e.g. patient education, nonsurgical periodontal therapy, prophylaxis as needed)	-
Determine the need to refer to dental providers for care outside of the dental hygiene scope of practice (e.g. prescribing medications, sedation, restorative care)	<ul style="list-style-type: none"> • Refer to provide necessary restorations, eliminate endodontic infections, correct restorative/iatrogenic factors, and diagnose/treat oral lesions/infections
Share proposed dental hygiene treatment plan with the consulting nephrologist and other health providers who care for the patient	<ul style="list-style-type: none"> • Communicate current oral health status, presence of acute/chronic conditions, planned treatments for oral health conditions, time required to complete dental hygiene treatment, and planned preventive care to optimize and maintain oral health
Coordinate dental hygiene treatment according to medical recommendations made by the consulting nephrologist	<ul style="list-style-type: none"> • Postpone dental hygiene treatment when necessary due to systemic health status when advised to do so by the nephrologist
Review any changes to the dental hygiene and dental care plan with the patient and discuss any considerations for treatment modifications	<ul style="list-style-type: none"> • Manage pain and anxiety as part of a stress reduction protocol to minimize risk for medical emergencies (e.g. administration of local anesthetics, length and time of appointments, analgesics, sedation)
Propose dental hygiene treatment plan to the patient and obtain informed consent	<ul style="list-style-type: none"> • Informed Consent: Review procedures, alternatives to proposed treatment, identify and address risks, and answer all questions • Observe the patient for level of understanding of proposed preventive dental hygiene treatment plan • Should the patient find the preventive care plan overwhelming, discuss alternative care suggestions, and focus on developing a plan that will ensure long-term compliance
Implementation	
Review and implement tailored dental hygiene care plan to achieve a level of oral health that is acceptable for transplant candidacy and/or to prevent rejection of renal transplant <ul style="list-style-type: none"> • Treat acute/chronic oral infections/disease (prioritize treating acute oral infections/disease first) • Prevent oral infections/disease 	Engage the patient in strategies to help ensure compliance
Provide dental hygiene services according to the treatment plan	<ul style="list-style-type: none"> • Treat all oral infections quickly and to completion using appropriate interventions to reduce risk for systemic complications and to restore oral health • Treat acute infections first (e.g. abscess), followed by chronic infections (e.g. periodontal disease) • Emphasize the importance of minimizing high levels of biofilm accumulation to reduce degree of drug-induced gingival hyperplasia • Management of oral ulcerations: Topical OTC products with benzocaine help to reduce severity and pain of ulcerations; use 0.12% chlorhexidine gluconate mouthrinses or refer to dentist for prescription strength anesthetic and analgesic preparations¹⁹

Figure 1: Dental and Dental Hygiene Actions According To the Process of Care (continued)

Evaluation	
Evaluate response to dental hygiene treatment and the need for additional interventions	<ul style="list-style-type: none"> • Pre-Transplant: Evaluate attainment of an acceptable level of oral health to ensure candidacy for renal transplant • Evaluate patient's ability to maintain this status while on the wait list (determine maintenance interval) • Post-Transplant: Evaluate attainment of an acceptable level of oral health to minimize risks for oral infections that could lead to renal transplant failure
Assess the effectiveness of the oral care plan on improving the patient's health outcomes during routine dental hygiene appointments	<ul style="list-style-type: none"> • Assess patient compliance with recommended oral hygiene care • Assess for recurrence of oral infections and/or oral manifestations of medications or systemic conditions (status of oral health: dental, mucosal, periodontal)
Reassess any patient concerns with the oral care regimen and oral health goals/expectations	<ul style="list-style-type: none"> • Give positive feedback to encourage continued daily care
Emphasize importance of continuing daily self-care and maintaining frequent maintenance intervals (e.g. 3 months)	<ul style="list-style-type: none"> • Emphasize the importance of oral health to candidacy for organ transplant and to ensure organ transplant longevity
Documentation	
Record all communication with the patient and health care providers in the treatment record	<ul style="list-style-type: none"> • Document communication between all treating medical and dental providers and the patient to optimize patient care
Communicate issues of concern in writing with collaborating dental, medical and other health providers who care for the patient	
Document the patient's response to dental hygiene treatment and compliance with recommendations	
Record recommendations for future dental hygiene treatment modifications	
Place copies of pertinent laboratory test results in the dental hygiene treatment record	

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