Prosthodontic Management of Immunocompromised Patients – A Review

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***Abstract*—Immunocompromised patients represent a unique challenge in prosthodontic practice due to their increased susceptibility to infections, delayed healing, and altered oral microflora. These patients may be medically compromised because of systemic diseases such as HIV/AIDS, diabetes, malignancies, or as a result of immunosuppressive therapy following organ transplantation or chemotherapy. The prosthodontic management of such individuals requires comprehensive understanding of their medical status, close coordination with the treating physician, and meticulous infection control measures. This review discusses the impact of immunodeficiency on oral tissues, considerations during diagnosis and treatment planning, and modifications required during fabrication of prostheses. Emphasis is placed on maintaining oral hygiene, using biocompatible materials, ensuring proper disinfection protocols, and adopting preventive strategies to minimize the risk of opportunistic infections. The article also highlights the importance of patient education and regular follow-up in achieving long-term success. A multidisciplinary approach that integrates medical and dental care is essential to restore oral function and improve the overall quality of life of immunocompromised patients.**

I.INTRODUCTION

Immunosuppressed patients present unique challenges in dental and prosthodontic care. Burtscher (2022) reported that organ transplant recipients on long-term immunosuppressive therapy, such as cyclosporine and tacrolimus, are particularly prone to postoperative infections, peri-implantitis, and impaired oss eointegration, underscoring the importance of individualized treatment planning and antibiotic prophylaxis for safe outcomes [1].

Similarly, through a systematic review and meta-analysis, demonstration, implant therapy in immunocompromised patients can achieve survival rates comparable to healthy individuals, provided that systemic conditions are stable and stringent infection control protocols are implemented. The study concluded that long-term follow-up and interdisciplinary care are indispensable to reduce complications [2].

The prevalence of immunocompromised patients in dental practice has increased due to advances in organ transplantation, oncology, and management of chronic systemic diseases. Immunosuppression may be primary, resulting from genetic disorders, or secondary, arising from systemic diseases such as HIV/AIDS, diabetes mellitus, or chronic kidney disease, as well as therapeutic interventions including chemotherapy, radiotherapy, corticosteroids, and biologics [5,3].

Prosthodontists are responsible for restoring oral function and esthetics while minimizing the risk of infections, delayed healing, and prosthetic complications. Standard protocols often require careful adaptation according to the patient's immune status. Failure to recognize these unique considerations may result in post-procedural infections, prosthesis failure, or systemic complications. Therefore, an in-depth understanding of immunocompromised conditions and their clinical implications is essential for safe and effective prosthodontic care.

II. CLASSIFICATIONS OF IMMUNOCOMPROMISED STATES

Understanding the type and degree of immunosuppression is critical for clinical decision-making.

2.1 Primary Immunodeficiencies

Primary immunodeficiencies are congenital disorders caused by genetic mutations affecting humoral or cellular immunity. Examples include severe combined immunodeficiency and common variable immunodeficiency. Patients typically present with recurrent infections and require specialized dental management, including stringent infection control measures and prophylactic antibiotic coverage [5].
Prosthodontic management must emphasize:

- Stringent infection control to avoid opportunistic infections
- Prophylactic antibiotic coverage before any invasive procedure
- Close medical liaison, as these patients often have ongoing systemic treatment

2.2 Secondary Immunodeficiencies

Secondary or acquired immunodeficiencies are more commonly encountered in prosthodontic practice and include:
Infectious causes: HIV/AIDS patients often show oral manifestation such as candidiasis, kaposis sarcoma, hairy leukoplakia, and necrotizing ulcerative periodontitis.[5]
Systemic diseases: Diabetes mellitus, chronic kidney disease compromise wound healing and increase infection risk
Therapy-induced immunosuppression: Chemotherapy, corticosteroids, post-organ transplant immunosuppresants reduce neutrophil function, impair lymphocyte counts, and hinder antibody production [1]
These conditions may impair neutrophil function, lymphocyte counts, or antibody production, significantly affecting susceptibility to infection and tissue healing

III. PROSTHODONTIC CONSIDERATIONS

3.1 Comprehensive Assessment

A thorough patient assessment is the cornerstone of prosthodontic management.

1. Medical History Review

Identify the cause and severity of immune suppression (primary vs. secondary).

- Medication review: Immuno suppressants (cyclosporine, tacrolimus, biologics), corticosteroids, or chemotherapy drugs may alter healing and drug interactions [5].
- History of infections and hospitalizations can help determine risk level.
- Systemic disease control: e.g., HbA1c for diabetic patients, CD4+ count/viral load for HIV-positive patients [3].

2. Laboratory Investigations

Complete Blood Count (CBC): Key values include absolute neutrophil count (ANC) and platelet count.
ANC < 1,000 cells/μL → significant infection risk.
Platelets < 50,000/μL → risk of bleeding during invasive procedures [1].
Serological markers: HIV, hepatitis, renal and liver function tests when indicated.
Coagulation profile for patients on anticoagulants after transplantation [3].

3. Oral Examination

- Detect existing oral infections (candidiasis, periodontal abscesses, caries).
- Assess for mucosal conditions: atrophy, ulcers, or mucositis induced by chemotherapy/radiotherapy.
- Evaluate salivary flow: Xerostomia is common in patients on anticholinergics, antidepressants, and radiotherapy, affecting prosthesis retention [3].
- Screen for periodontal status and bone quality, which influence fixed or implant-based treatment [5].

3.2 Risk Stratification

Risk stratification helps in deciding the extent of procedural modifications required:

- Low-risk group:

Mild immunosuppression or well-controlled systemic disease (e.g., controlled diabetes, stable HIV with CD4 > 500/μL).
Standard infection control measures usually adequate

- Moderate-risk group:

Patients on low-dose immunosuppressants, partially controlled diabetes, or HIV with CD4 counts 200–500/μL.

Require modified protocols: shorter appointments, antimicrobial rinses, and atraumatic techniques

- High-risk group:

Organ transplant recipients on multiple immunosuppressants, chemotherapy patients with neutropenia, severe congenital immune deficiencies.

Require strict aseptic protocols, prophylactic antibiotics, hospitalization in some cases, and close liaison with the medical team [1].

3.3 Treatment Planning Considerations

1. Infection control is central: Even minor oral infections can become life-threatening in immunocompromised patients

2. Stress reduction protocols: Use of short, morning appointments to minimize fatigue and risk of systemic decompensation

3. Avoidance of elective procedures during periods of severe immunosuppression (e.g., chemotherapy-induced neutropenia).

4. Patient motivation and education: Importance of oral hygiene, denture cleaning, and regular recall must be emphasized [5].

3.4 Procedural Modifications

Impression making:

- Use less traumatic techniques (e.g., silicone rather than alginate for edentulous arches when mucosa is fragile).
- Avoid excessive border molding pressure to prevent mucosal ulceration [5].
- Bite registration and occlusion:

Avoid excessive occlusal forces which may traumatize fragile mucosa.

Simplified occlusal schemes in removable prostheses reduce stress on soft tissues [3].

Prosthesis design:

- Ensure smooth and polished surfaces.
- Minimize undercuts where plaque accumulation is likely.
- Relief areas over thin mucosa to avoid trauma [5].

Atraumatic clinical techniques:

- Avoid aggressive gingival retraction (cord packing, electrocautery).
- Use retraction pastes or lasers when necessary
- In implant placement, flapless surgery is preferable to reduce trauma and infection risk [1].

3.5 Psychological and Social Considerations

- Immunocompromised patients often face:
- Reduced quality of life due to chronic illness, disfigurement, or loss of function.
- Psychological stress and anxiety, which may affect compliance with prosthodontic care.
- Social stigma (particularly in HIV/AIDS patients) influencing their willingness to seek treatment [3].

IV. INFECTION CONTROL AND PROPHYLAXIS

4.1 Antibiotic Prophylaxis

Rationale:

Immunosuppressed patients have impaired host defense mechanisms (e.g., neutropenia, lymphocyte dysfunction, reduced antibody production), making them more prone to bacterial and fungal infections. Invasive dental procedures create a portal of entry for microbes, which can result in septicemia or localized infections with poor healing. Prophylactic antibiotics help prevent these complications, especially in high-risk cases [4].

Indications:

- Organ transplant recipients on immunosuppressants.
- Patients undergoing chemotherapy or radiotherapy with reduced neutrophil counts.
- Severe congenital immunodeficiency.
- Poorly controlled systemic diseases such as diabetes mellitus with frequent infections.
- Invasive dental procedures: implant placement, surgical extractions, alveoloplasty, and extensive periodontal manipulation [1]

Regimens (to be tailored in consultation with the physician):

- Standard regimen: Amoxicillin 2 g orally, 1 hour before procedure (adults); 50 mg/kg (children).
- Penicillin allergy: Clindamycin 600 mg orally, 1 hour before procedure (adults); 20 mg/kg (children).
- Alternative macrolides (physician-approved): Azithromycin or clarithromycin 500 mg orally, 1 hour before procedure.

- Postoperative extension (select high-risk patients): Short courses (3–5 days) of amoxicillin or clindamycin may be prescribed, but extended use must be justified and guided by the physician to avoid resistance [5].

Key considerations:

- Always obtain medical clearance before prescribing antibiotics.
- Adjust dosage for patients with renal/hepatic impairment.
- Be aware of drug interactions with immunosuppressive therapy (e.g., macrolides increasing cyclosporine/tacrolimus levels).
- Emphasize antimicrobial stewardship: avoid unnecessary prophylaxis in low-risk cases.

4.2 Aseptic Protocols

Antibiotics alone cannot substitute for rigorous infection control during prosthodontic procedures. Strict aseptic measures reduce microbial exposure and prevent complications:

1. Pre-procedural measures

- Antimicrobial rinses: 0.12%–0.2% chlorhexidine mouth rinse for 30–60 seconds before procedures to reduce salivary microbial load.
- Oral decontamination: Address pre-existing infections (periodontitis, candidiasis) before prosthodontic treatment whenever possible [5].

2. Operatory and instrument sterilization

- Adherence to CDC/WHO infection control protocols: autoclaving instruments, using sterile packs, disinfecting surfaces with hospital-grade disinfectants.
- Use of sterile gloves, masks, and protective barriers.
- For high-risk patients, consider scheduling appointments in an operatory with enhanced aseptic protocols (similar to minor surgical settings) [5].

3. Procedural modifications

- Atraumatic impression techniques: Use less compressive materials (elastomers) and avoid excessive pressure on fragile mucosa.
- Minimize mucosal trauma: Smooth tray borders, relief in custom trays, avoid sharp edges on prostheses.
- Reduce exposure time: Keep appointments short to minimize stress and microbial exposure.
- Digital impressions/CAD-CAM: These eliminate impression materials contacting mucosa and reduce risk of secondary infections [5].

4. Protective strategies for prostheses

- Highly polished surfaces to reduce plaque adherence.
- Use of disinfectants for removable prostheses (e.g., sodium hypochlorite 0.5%, chlorhexidine).
- Patient education on daily cleaning routines.

4.3 Postoperative Monitoring

Rationale:

Due to delayed healing, immunocompromised patients are at higher risk for postoperative infections and wound dehiscence. Early intervention prevents minor complications from escalating into systemic infections.

Follow-up protocols:

- Immediate review within 48–72 hours post-procedure to check for pain, swelling, erythema, or pus discharge [2].
- Subsequent recalls at 1 week, 2 weeks, and monthly until full mucosal healing is achieved.
- For implants: follow-up every 3–4 months to assess peri-implant tissues radiographically and clinically.

Monitoring parameters:

- Soft tissue healing: Look for erythema, ulceration, candidal patches.
- Bone healing (post-implant or extraction): Radiographic checks for bone fill and absence of osteomyelitis.
- Systemic signs: Fever, malaise, lymphadenopathy may indicate spreading infection.

Management of complications:

If infection is detected:

- Early empirical antibiotic therapy in consultation with the physician.
- Culture and sensitivity testing where feasible.
- Hospital referral for IV antibiotics in case of systemic involvement.

If delayed healing:

- Use tissue conditioners under prostheses.
- Topical antifungals for candidiasis.
- Reevaluate systemic condition (e.g., neutropenia, uncontrolled diabetes).

Patient education:

Inform patients of warning signs: persistent pain, swelling, bleeding, or prosthesis irritation.

V. PROSTHODONTIC TREATMENT OPTIONS

5.1 Removable Prostheses

Removable prostheses are frequently preferred in immunocompromised patients because they are non-invasive, reversible, and allow continuous mucosal monitoring.

Design Principles:

- Smooth and highly polished denture surfaces to minimize plaque and fungal adherence.
- Relief areas over fragile mucosa to avoid trauma and ulceration.
- Lightweight acrylic or cobalt-chromium frameworks for better tolerance.
- Tissue conditioners to reduce irritation in cases of mucosal soreness [5}.

Maintenance:

- Daily cleaning and immersion in disinfectant solutions (e.g., chlorhexidine, sodium hypochlorite) to reduce Candida albicans colonization
- Regular recall visits for adjustments, relining, or replacement to accommodate tissue changes [6].

Advantages:

- Non-invasive, safe, and cost-effective
- Easily adjustable to suit changing mucosal or systemic conditions.
- Permit close observation of soft tissue health [3].

Limitations:

- Higher risk of denture stomatitis and candidiasis in immunosuppressed patients
- Long-term wear can accelerate alveolar bone resorption.

5.2 Fixed Prostheses

Fixed restorations can be considered for patients with stable systemic conditions and adequate periodontal support.

Treatment Planning Considerations:

- Thorough assessment of abutments for caries and periodontal health.
- Supragingival or equigingival margins are preferable to reduce gingival trauma and bacterial colonization [5].
- Avoid aggressive gingival retraction (cord packing, electrocautery) that may impair healing; instead, use retraction pastes or laser techniques [6].

Material Selection:

- Zirconia and titanium restorations demonstrate superior biocompatibility and reduced microbial adherence compared to conventional alloys [1].
- High-quality ceramics provide esthetics and tissue compatibility with lower plaque accumulation [2].

Clinical Modifications:

- CAD/CAM technology reduces chairside time, which is beneficial in immunocompromised patients Ensure well-finished, smooth temporary crowns to prevent microbial colonization [5].

Advantages:

- Provides excellent esthetics and function [2].
- Better long-term durability than removable prostheses in stable patients.

Limitations:

- Requires irreversible tooth preparation.
- Increased risk of secondary caries, especially in patients with xerostomia induced by medications [3].

5.3 Dental Implants

Implant therapy is a viable option in carefully selected immunocompromised patients, particularly when systemic conditions are well-controlled.

Case Selection:

- Contraindicated in patients undergoing active chemotherapy, uncontrolled HIV, or acute transplant rejection episodes [1].
- Feasible in patients with controlled diabetes, stable transplant status, or post-cancer remission

Surgical Considerations:

- Minimally invasive surgery and flapless approaches reduce trauma and infection risk [1]
- Staged loading protocols recommended to allow prolonged osseointegration
- Antibiotic prophylaxis (pre- and post-operative) is often essential and must be planned with the physician
- Strict sterile protocols and short chairside exposure are crucial [5].

Prosthetic Considerations:

- Implant-supported overdentures reduce mucosal trauma and improve retention compared to complete dentures.

- Fixed implant-supported prostheses may be considered if systemic and bone health are adequate .
- Titanium and zirconia abutments preferred due to favorable soft tissue response [2].

Maintenance Protocols:

- Short recall intervals (every 3–4 months) for peri-implant health assessment
- Emphasize meticulous oral hygiene with powered toothbrushes, chlorhexidine rinses, and water flossers
- Periodic radiographs to detect early peri-implant bone loss [1]

Advantages:

- High success rates reported when systemic disease is well controlled
- Improved mastication, esthetics, and quality of life

Limitations:

- Increased surgical risk in severely immunocompromised states.
- Higher cost and strict maintenance demands [6]

VI. HEALING AND TISSUE MANAGEMENT

Immunosuppression may delay soft tissue and bone healing:

Soft tissue management: Gentle handling, tissue conditioners, and regular monitoring

Bone regeneration: Grafting materials may be used with careful timing to minimize infection risk

Follow-up protocol: Extended observation and maintenance schedules improve long-term outcomes [3]

VII. EMERGING STRATEGIES AND FUTURE DIRECTIONS

7.1 Minimally Invasive Techniques

Digital impressions, CAD/CAM restorations, and minimally invasive procedures reduce tissue trauma, procedural time, and infection risk [6].

7.2 Advanced Biomaterials

Biocompatible, antimicrobial, and low-porosity materials minimize microbial colonization, enhance mucosal tolerance, and improve prosthesis longevity [1].

7.3 Patient-Centered Care

Patient education on oral hygiene, prosthesis maintenance, and early detection of mucosal changes is essential. Digital reminders, tele-dentistry follow-ups, and home-care monitoring improve compliance and safety [3,5].

VIII. DISCUSSION

Prosthodontic management of immunocompromised patients requires an individualized, evidence-based approach that considers systemic health, infection control, and multidisciplinary collaboration. With the rising number of patients receiving organ transplants, chemotherapy, radiotherapy, or immunosuppressive medications, clinicians frequently encounter individuals with compromised immune function who need oral rehabilitation [2].

Studies have demonstrated that implant and prosthodontic therapy can be successful in immunocompromised patients if the systemic condition is well controlled and appropriate modifications are followed [8]. Preoperative medical evaluation, including hematologic investigations and consultation with physicians, helps in determining the timing and safety of dental procedures [7].

In these patients, maintaining strict asepsis is crucial to prevent postoperative complications. The use of pre-procedural antiseptic rinses, prophylactic antibiotics for high-risk cases, and sterilization protocols are recommended to minimize infection risk [11]. Proper infection control, combined with antimicrobial stewardship, ensures effective prevention while avoiding unnecessary antibiotic use.

Prosthodontic procedures should be minimally invasive and stress-free, as trauma or prolonged chairside time can increase the risk of delayed healing and infection. Atraumatic impression techniques, simplified occlusal schemes, and the use of biocompatible materials such as titanium and zirconia are advisable to promote tissue tolerance and longevity [10].

For patients with HIV/AIDS or post-COVID-19 mucormycosis, special considerations include mucosal fragility, xerostomia, and psychological distress. Smooth and highly polished prosthesis surfaces, tissue conditioners, and thorough hygiene instructions help prevent infections such as oral candidiasis and mucosal ulceration [9].

Regular recall and maintenance appointments are essential to monitor mucosal integrity, prosthesis adaptation, and oral hygiene status. Early identification and management of complications ensure long-term success. The collective evidence emphasizes five key principles for prosthodontic management in immunocompromised patients:

1. Comprehensive systemic assessment and coordination with the physician
2. Strict infection control and aseptic protocols
3. Minimally invasive and conservative clinical procedures
4. Use of highly biocompatible materials and smooth prosthesis design and
5. Continuous follow-up and maintenance

Although available evidence supports favorable outcomes, most studies are limited in sample size and duration. Hence, further prospective research is needed to establish standardized guidelines and evaluate long-term prosthodontic success in different immunocompromised populations.

9.Conclusion

Prosthodontic rehabilitation in immunocompromised patients is feasible and effective when guided by comprehensive evaluation, interdisciplinary coordination, and strict infection control. Evidence indicates that both removable and implant-supported prostheses can achieve predictable outcomes in well-selected patients [8].

Treatment planning should prioritize patient safety through minimally invasive approaches, careful material selection, and adherence to aseptic techniques [9]. Regular recall, hygiene reinforcement, and patient education are essential to maintain prosthesis health and prevent opportunistic infections. Collaboration between prosthodontists and medical specialists ensures that dental interventions coincide with periods of optimal immune stability, enhancing healing and systemic safety [12]. Future research should aim to refine standardized protocols and explore the use of advanced biomaterials with antimicrobial properties to further improve outcomes for this vulnerable patient group.

REFERENCES

[1] Burtscher D. Dental implant procedures in immunosuppressed organ transplant patients. Clinical Implant Dentistry and Related Research. 2022;24(5):678-685.
[2] Duttenhoefer F. Dental implants in immunocompromised patients: A systematic review and meta-analysis. Journal of Implant Dentistry. 2019;28(4):1-8.
[3] Bourgoin A. Management of dental care of patients on immunosuppressive therapy. Journal of Clinical Dentistry. 2023;34(2):45-50.
[4] Squire JD. Antibiotic prophylaxis for dental treatment in patients with primary immunodeficiency diseases. Journal of Allergy and Clinical Immunology: In Practice. 2019;7(5):1543-1549.
[5] Pruthi DG. Comprehensive review of guidelines to practice in dental care for immunocompromised patients. Journal of Prosthodontic Research. 2020;64(3):123-130.
[6] Bukhari MA, et al. Immunocompromised patients and dental implant: A review. International Journal of Community Medicine and Public Health. 2022;9(9):3605-3609.
[7] Ghimire B, et al. Management of Medically Compromised Prosthodontic Patients. Cureus. 2022;14(12): e32872.
[8] Hedari R, et al. Dental Implant Treatment in Medically Compromised Patients. Open Dent J. 2023;17: e187421062306080.
[9] Singla M, et al. Prosthodontic rehabilitation of AIDS patients: An overview. Int J Dent Sci. 2018;10(1):45–50.
[10] Aggarwal H, et al. Maxillofacial Prosthodontic Rehabilitation in Post-COVID-19 Mucormycosis Patients. Cureus. 2023;15(1): e33406.
[11] Deng J, et al. Infection control measures for dental treatment of immunocompromised patients: A comprehensive review.
[12] Papi P, et al. Dental management of patients undergoing immunosuppressive therapy: A review.