Principles and practice of ethically responsible implant dentistry

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Executive summary

Clinical significance

- Ethical responsibilities are paramount to ensure patient safety and uphold professional standards.
- Patients rely on their dentist to act with integrity, provide honest information, and prioritise their well-being.
- Upholding ethical principles and practices fosters trust, enhances patient satisfaction, and strengthens the clinician's professional reputation.

Key points

- Ethically responsible implant dentistry means applying your knowledge and skills to an appropriate standard of care that is in every aspect in the patients' best interest.
- Ethical principles promote transparency and patient confidence in informed treatment decisions.
- Effective risk management involves appropriate competencies, comprehensive pre-operative assessments, precision in surgical techniques, diligent postoperative care, and ongoing maintenance to ensure long-term success.

Practice implications

- Engaging in ongoing education and evidence-based protocols to ensure high standards of care and professional competence.
- Ensure that patients are involved in clinical decision-making and are knowledgeable about treatment procedures, risks, potential complications, alternative options and cost implications.
- Maintain detailed records of consent discussions and signed consent forms.
- Ensure that patients are knowledgeable on the importance of regular oral hygiene maintenance, follow-up visits and have the physical capacity and personal responsibility to maintain aftercare.

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Background

The rising popularity of implant dentistry has been one of the most significant trends in modern dentistry for restoring missing teeth. It has become a widely accepted and frequently performed procedure worldwide, driven by a growing awareness in oral

health, an increasing demand for a more durable, permanent and aesthetic solution to tooth loss, a growing geriatric population, high incidence of dental conditions resulting in tooth loss, and advancements in dental technology and materials, combined with increasing predictability and high survival rates.[1-3]

In addition, acceptance among patients has further increased due to more favourable conditions such as immediate implant placement, immediate loading, and flapless procedures, which reduce healing times.[4]

The use of dental implants is considered a reliable treatment for tooth loss, with extensive research revealing compelling evidence demonstrating survival rates of 97% at 10 years and 75% at 20 years.[3,5,6] These findings are not only substantiated by many individual studies but also by comprehensive systematic reviews and high-quality meta-analyses.[7-9] Factors such as proper oral hygiene, regular dental visits, and the patient's overall health significantly influence these success rates, emphasising the importance of post-operative care and maintenance.[5]

Despite the high success rates, risks, complications, and adverse effects associated with dental implants do occur, and if not adequately managed, can compromise patient safety and clinical outcomes. Early biologic complications include surgical trauma, infections, and implant failure due to poor osseointegration. The complications involve peri-implant disease and bone loss, and mechanical failures (e.g., screw loosening, screw/implant fracture) resulting in implant loss.[10] A systematic review by Derks and Tomasi[11] estimated the prevalence of peri-implant disease, which ranges between 19 and 65%, underscoring a significant challenge to dental practitioners for long-term implant maintenance. The overall incidence of hardware complications is still at a high level, with a 5-year incidence ranging from 16.3%-53.2%.[12] Furthermore, biomechanical complications such as prosthetic component fractures occur in 5-10% of cases, often requiring complex interventions.

Implant failure causes are multifactorial.[5] Risk factors associated with a higher probability of implant failures include: (i) topography and bone quality (i.e., type III-IV low bone density in the maxilla);[13] (ii) uncontrolled periodontitis;[13] (iii) bruxism;[14] (iv) pre-implant sinus lift surgery;[13,15,16] (v) active smoking;[13,17,18] (vi) systemic diseases (i.e., rheumatoid arthritis, diabetes, cardiovascular diseases);[13,14] (vii) inadequate 3D positioning of the implant, peri-implant bone thickness and vascularization;[19] and (viii) surgical site infection.[13,20]

The incidence of early implant failures, defined as the inability of tissue to establish osseointegration, which was considered to occur during the early healing phase after implant surgery, is reported to be 5.6%.[21-23]

Despite the increasing number of dental implants being placed and high success rates, complications and failures do occur, exerting a substantial biological and financial burden on patients and the healthcare system, and posing a formidable challenge to dentists.[24] Irrespectively, implant placement thus remains a complex surgical procedure requiring ethical responsibility and legal compliance to ensure that the patients' best interest is respected, patient safety and professional integrity.

Purpose

The purpose of this review is to provide dental practitioners with a comprehensive understanding of strategies and guidelines for mitigating risks through ethically responsible clinical risk assessment, diagnosis, treatment planning, placement, surgical risk management and safety protocols, and aftercare and maintenance of peri-implant tissues and implant-supported prosthetics. An ethically responsible approach to implant dentistry will optimise safety, improve treatment outcomes, promote patient satisfaction and welfare, and uphold professional integrity.

Ethical principles of clinical decision-making

As the demand for dental implants increases, ethical considerations play a critical role in guiding clinical decision-making and ensuring patient-centred care. Ethical dilemmas may arise due to patient expectations, clinical decision-making, financial concerns, or complications arising from patient-related risk factors or surgical or prosthetic-related factors, requiring careful navigation through ethical frameworks and professional guidelines.

Four fundamental ethical principles provide the framework for professional judgment and clinical decision-making for ethically responsible implant practice, namely nonmaleficence (protecting the patient from harm), beneficence (acting in the patient's best interest), autonomy (respecting the patients' right to self-determination), and justice (fair and equitable treatment).[25]

The principles of non-maleficence and beneficence require practitioners to minimise harm by employing evidence-based management strategies and, when necessary, referring patients to specialists. Ethical practice also demands veracity (truthfulness), meaning dentists must provide honest assessments of failure causes without misrepresentation.[26] In addition, dentists are obligated to uphold veracity (truthfulness) by providing truthful information

about treatment outcomes, success rates, risks, potential limitations, alternative treatments, costs, and avoiding misleading claims or overtreatment for financial gain.[10]

These fundamental ethical principles provide the ethical foundation for responsible implant practice, ensuring that patients' best interest and well-being remains the primary focus.

Ethical practices and responsibilities to mitigate risks

Ethical responsibilities in providing a high standard of care, as well as preventing and managing complications and failures in implant dentistry, revolve around transparency, accountability, and patient-centred care. Dental implant therapy is a widely accepted modality for tooth replacement, with high success rates when appropriate protocols are followed. Effective pre-, peri-, and post-operative planning, using evidence-based protocols, is critical for preventing risks and managing complications such as infection, peri-implantitis, and implant failure.[27-29]

• *Ensure knowledge and professional skills meet appropriate standards of competence*

Implant dentistry is highly technique-sensitive, requiring competencies that necessitate ongoing skills development to update evidence-based knowledge of evolving techniques and biomaterials, and maintain proficiency in diagnostic, surgical and prosthetic skills.[10] Engaging in structured educational and skills development or participating in mentoring programs enables practitioners to refine their skills and apply evidence-based practices and preventive measures.[30] This commitment to lifelong learning ensures that dentists can provide the highest standard of care, adapt to advancements in the field, and effectively address complex clinical scenarios or refer complex cases to specialists when necessary.[10]

Failure to maintain professional competence not only compromises patient outcomes and best interests but also exposes the dentist to ethical scrutiny and legal liability. Ultimately, continuous professional development upholds the principles of acting in the patients' best interest and protecting the patient from harm, thus enhancing patient outcomes and upholding professional integrity.

• *Pre-operative risk assessment and treatment planning*

Not all patients are ideal candidates for implants. Risk assessment and patient selection are critical ethical responsibilities that impact treatment success and patient safety. The principle of non-maleficence requires avoiding treatment in high-risk patients if the potential for harm outweighs the benefits.

Thorough medical and dental evaluations to identify high-risk patients are therefore essential before initiating implant therapy to mitigate potential risk factors that may cause complications resulting in harm to the patient.[28,31]

Knowledge and Skills Competencies Checklist

1. Formal education and certification in implant dentistry
2. Up-to-date knowledge of anatomy, biomaterials and surgical techniques
3. Continuous professional development and hands-on training
4. Bone and soft tissue augmentation and grafting techniques
5. Biomaterials
6. Suturing techniques
7. Understanding of occlusion, prosthetic design, and bone biology
8. Competence in diagnostic tools (e.g., CBCT)
9. Prevention and management of complications
10. Awareness of the scope of practice and referral when outside personal expertise

Medical history and systemic conditions

Various systemic conditions such as diabetes, cardiovascular conditions, osteoporosis and immune disorders, and the drugs used to treat them, especially in elderly patients, have been shown to impede or complicate dental implant surgery.[31,32] Poorly controlled diabetes may impair wound healing and increase the risk of infection.[32] Patients taking bisphosphonates[33] or anticoagulants[34,35] may require special considerations to prevent complications like osteonecrosis of the jaw or excessive bleeding during surgery. Identifying allergies to anaesthesia, antibiotics, or implant materials is crucial for personalised care.[36] Acute illness, uncontrolled metabolic disease, bone or soft tissue pathology/infection, is considered an absolute contraindication for placing implants.[36,37]

Dental history and oral health

A comprehensive dental examination should include an analysis of the patient's oral hygiene, periodontal status, occlusion,

endodontic integrity and vitality of remaining teeth, integrity of existing restoration, restorative space and the position and angulation of roots in the alveolar bone that may require orthodontic treatment.[38]

Poor oral hygiene and active periodontal disease increase the risk of peri-implant disease and implant failure; therefore, restoring oral hygiene and treating dental infections and periodontal disease is critical before implant therapy.[31,39,40] It is also important to assess the patient's physical capacity to maintain oral hygiene after treatment for periodontal disease and implant therapy.[31] It is ethically irresponsible to place implants for patients who are physically and mentally incapacitated, or have no resources or means to perform proper aftercare.

Chronic teeth grinding (bruxism) can exert excessive forces on implants and implant-supported prostheses, jeopardising their stability.[41,42] Night guards may thus be required after placing implant-retained prostheses.

Identifying risk factors

The risk of early implant failure is generally greater in patients who are smokers, in the posterior maxilla, with a history of periodontal problems, with type IV bone, augmented bone, and immediately loaded cases.[43] Another study found that poor oral hygiene, history of periodontitis, and a keratinised mucosa < 2 mm were prognostic indicators for peri-implant diseases.[44] Smoking is a well-documented risk factor that impairs osseointegration and increases the risk of peri-implantitis.[45,46] Smoking adversely affects blood flow and healing, leading to higher rates of implant failure and complications.[13,17,47] Therefore, counselling patients to quit smoking is often necessary. Patients on anticoagulant medication are at risk of bleeding.[34] Identifying behavioural risk factors such as smoking or high alcohol consumption,[48] and poor oral hygiene,[31] should be addressed as part of the risk mitigation process.

Radiographic imaging and virtual implant planning

A comprehensive dental assessment should include radiographic imaging (e.g., CBCT) to evaluate bone volume and quality, anatomical landmarks, and potential need for augmentation and the planning of implant design (diameter and length) and the precise implant placement angle and depth.[27,49,50] Three-dimensional digital planning software enables clinicians to create surgical guides based on CBCT data. Surgical guides improve the accuracy of implant placement, reduce surgical risks, and enhance outcomes.

Appropriateness of treatment or referral

Implant placement is an invasive procedure and frequently involves the removal of a tooth or teeth and alveolar bone and soft tissue augmentation, increasing the risk of complications, often protracted in nature, and lastly, among the most costly treatment options.10 Therefore, dentists have an ethical responsibility to assess whether implant therapy is appropriate and to refuse treatment when the risks outweigh the benefits. Offering implants without proper evaluation or placing implants in patients who are not suitable candidates can result in complications.

Evidence-based treatment planning and strict maintenance and follow-up protocols are therefore essential to uphold ethically responsible practice.[51] In cases where a patient is deemed unsuitable, referring them to specialists or recommending alternative treatments aligns with beneficence and professional integrity. By prioritising patient safety and individualised treatment planning, dentists can enhance implant success rates while maintaining ethical and responsible care. [52]

Inform before perform: Informed consent

Informed consent is a fundamental ethical principle and legal obligation in implant dentistry, ensuring that patients actively participate in their treatment decisions and respect their right to self-determination (autonomy). The starting point of disclosing information must be aligned with the patients' best interest, prioritising the patient's safety, well-being, comfort, and expectations in all decision-making processes.[53]

Pre-operative Checklist

1. Medical and Dental history– systemic conditions, medications and allergies
2. Consult and collaborate with the treating physician regarding systemic conditions and medications
3. Oral hygiene at an appropriate level
4. Periodontal health
5. Smoking cessation
6. Radiographic imaging - virtual implant planning
7. Treat infections (i.e., endodontics, periodontal disease, extractions)
8. Extraction and augmentation were indicated
9. Prophylactic antibiotics
10. Availability and readiness of appropriate implant components and biomaterials
11. Appropriateness of treatment or referral

Dentists have to provide clear, comprehensive, and truthful information about the scope of implant procedures (i.e., surgical steps, materials used, and expected healing times), including risks, benefits, costs (financial implications), potential complications (e.g., peri-implant disease, implant failure, prosthodontic complications), and alternative treatment options, their advantages, disadvantages, and expected outcomes before undergoing implant surgery.[54,55] Ethical communication is particularly essential when discussing complex procedures such as provisionalization, bone and soft tissue grafting, sinus lifts, or full-arch rehabilitation, which carry additional risks and financial implications.

Alternative treatment options should be presented, compared and explained.[10] Furthermore, there should be specific grounds for indicating the plausibility or advisability of an alternative treatment option.[10] It is unethical to base a treatment plan on beliefs such as the public notion that an implant will last forever to motivate the extraction of a tooth. Furthermore, it is unethical to extract compromised teeth and replace them with dental implants when it is not in the patient's best interests.[51] Dental practitioners also need to fully discuss the requirements for ongoing aftercare and the maintenance of optimal oral hygiene, and regular follow-up visits that are part of undertaking implant treatment.[55] Patients undergoing implant treatment need to be aware of the commitment to post-placement maintenance, which should be part of the consent process.[55] The dentist needs to fully discuss the requirements for ongoing maintenance that are part of undertaking implant treatment.

Comprehensive disclosure and discussions allow patients to make an informed, voluntary choice without coercion or misinformation. A lack of informed consent can compromise patient autonomy, leading to dissatisfaction, unrealistic expectations, and potential legal disputes. The informed consent process should be ongoing, not just a one-time formality, allowing patients to ask questions and reconsider their decisions. Ethical concerns arise when patients are given insufficient information or feel pressured into treatment. Additionally, special considerations are necessary for vulnerable populations, such as elderly patients or those with cognitive impairments, to ensure true understanding and voluntary decision-making. The entire information content discussed with the patient must be provided in a language which the patient understands, and in a manner that considers the patient's literacy level.[10]

Finally, all discussions should be fully documented in the patient's clinical record to validate consent and to support the dentist if any complaint is raised about the delivery of care.[27,55] Signed consent forms can be helpful and sometimes mandatory, but should be specific to the individual treatment planned, rather than an all-encompassing, general consent form. Respecting patient autonomy fosters trust, satisfaction, and adherence to treatment plans, ultimately leading to better long-term outcomes in implant dentistry.

Informed consent checklist

1. Treatment options
2. Surgical steps
3. Materials used
4. Expected outcomes
5. Risks and benefits
6. Potential complications and implications
7. Costs, time and long-term commitments
8. Discussion without coercion
9. Document and record keeping of discussions
10. Signed consent forms

Surgical risk management and safety protocols

Dental implant placement, like any surgical procedure, has potential risks that can affect patient health and treatment outcomes. Therefore, a patient-centred approach that prioritises safety, precision surgery, and enhanced clinical outcomes is essential towards upholding ethically responsible practice.[52] The management of surgical risks underscores the need for thorough risk assessment, planning, precision during surgery, and diligent post-operative care.[56] Proper surgical protocols such as sterilisation, precision implant placement that is both biologically and restoratively driven, and risk mitigation strategies are essential to minimise complications during dental implant surgical procedures and promote successful biological, functional and aesthetic outcomes.[38,57]

Meticulous surgical planning based on diagnostic wax-ups and guided templates can minimise intra-operative errors. Minimally invasive techniques and proper implant positioning reduce trauma and enhance primary stability. Atraumatic handling of soft and hard tissues further supports favourable healing and osseointegration. Surgical considerations should include flap design, one or two-stage protocol, position and angulation of the implant, primary stability, need for augmentation, biomaterials required, healing abutment, loading, and suturing technique. Teeth

Surgical risk management and safety protocols checklist

1. Accurate pre-surgical planning (Diagnostic models, CBCT, Surgical guides)
2. Proper anaesthesia
3. Sterile protocol
4. Implant design, flap design
5. Emergency protocol for management of complications.
6. Precision surgical technique – biologically and restorative driven
7. Implant stability
8. 1-2-stage approach, healing abutment, loading, suturing technique
9. Post-operative instructions and medications
10. Surgical documentation (Notes, photos, x-rays, components, ISQ)

that must be extracted for immediate implant placement should be done with minimum intervention.[38] Advances in technology, such as cone beam computed tomography (CBCT), guided surgery, and biocompatible materials, are pivotal in enhancing safety, minimising risks and optimising treatment outcomes.

Diligent post-operative care (0–4 Months Post Dental Implant Placement)

Post-operative care is aimed at preventing infections and poor clinical outcomes (e.g., improper osseointegration, peri-implant disease, implant failure, and mechanical complications such as loosening or fracture of implant components) and ensuring long-term implant success. These measures collectively enhance treatment outcomes and minimise complications. Patients should be provided with clear verbal and written post-operative instructions. These advise patients to avoid disturbing the surgical site (i.e., brushing), to follow a soft diet and to use their prescribed medication (i.e., anti-inflammatories, pain). Oral hygiene should be maintained, followed by gentle mouth rinsing with chlorhexidine 0.12–0.2% twice daily for 1–2 weeks. Cold drinks, food or compresses are recommended to reduce swelling. Smoking and alcohol should be avoided.

Current evidence suggests that antibiotic prophylaxis for dental implant surgery seems to have no substantial effect

Post-operative care/ protocol checklist

1. Written and verbal post-op instructions provided
2. Pain and infection management (medication guidance)
3. Emergency contact information given to the patient
4. Monitoring for complications (bleeding, infection, implant stability)
5. Schedule post-op check-up and suture removal
6. Reinforce oral hygiene instructions
7. Follow-up assessment of implant stability
8. Documentation of healing progress.
9. Impressions of implant
10. Placement of final implant prostheses

on preventing post-operative infection and early implant failure, and does not support routine antibiotic prophylaxis for dental implant surgery in healthy patients.[58-60] Despite the lack of conclusive supportive evidence, antibiotics are often administered to reduce the risk of infection, which could lead to early implant failure. Increasing antibiotic resistance is a major concern, and it is therefore important to reduce the overall use of antibiotics, including in dentistry.[59,60] Clinicians should carefully consider the individual patient's risk factors, the potential benefits and harms of antibiotic prophylaxis, and the available evidence when making decisions about antibiotic use in dental implant surgery.[58]

After 2 weeks, review healing, remove non-resorbable sutures, and reinforce oral hygiene instructions. Regular follow-ups may be required to monitor healing, peri-implant tissue health status, and oral hygiene compliance, depending on the patients' risk profile. Radiographs and ISQ assessment may be taken at 8-18 weeks post-operative to assess osseointegration. Schedule implant exposure if the submerged technique was used, and plan for the prosthetic phase after confirmation of osseointegration.

Aftercare, Maintenance and Monitoring for Long-Term Implant Success

Implant-supported treatment normally entails long-term care. Dental practitioners thus have a duty of care to ensure that a maintenance program and follow-up protocol are in place to monitor their patients.[55] Integration of a supportive periodontal care program has been shown to reduce

Long-term aftercare and maintenance checklist

1. Patient education on maintenance and hygiene
2. Regular professional check-ups and oral hygiene care
3. Monitoring for peri-implant disease
4. Ongoing evaluation of occlusion and prosthesis fit
5. Radiographic assessment at regular intervals
6. Encourage smoking cessation and a healthy lifestyle
7. Clear recall schedule for contingency plan to manage complications
8. Documentation of all follow-up and maintenance visits

the incidence of peri-implant disease.[61] Aftercare and maintenance are of fundamental importance, especially for individuals with reduced capacities or in need of assistance.[10]

Aftercare and maintenance protocol should uphold the following basic practices to comply with ethical responsibilities: (i) reinforce oral hygiene maintenace and compliance; (ii) schedule follow-up visits every 3–6 months based on patient risk profile to evaluate peri-implant tissues and prosthetic integrity and stability; (iii) maintain thorough documentation of clinical records with baseline and follow-up data; and (iv) educate patients about the importance of ongoing care and reporting early signs of complications.[62] Although a long-term survival can be expected, long-term follow-up care is essential and shouldn't end after insertion or even after 10 years.[5]

Legal obligations and good practice in implant dentistry

In healthcare professions, laws and regulations govern standards of practice and professional conduct with the common aim of protecting patient safety and setting professional standards of care. Communities in general also have expectations about how professionals, such as dentists, should conduct their practice. These expectations are often embodied in ethical codes or guidelines developed by professional groups and regulatory bodies such as the Health Professions Council of South Africa.63 These codes provide guidelines for good practice and professional responsibilities that dental practitioners owe to their profession, to their colleagues, and the community at large. Failure to meet these obligations can result in malpractice claims, leading to legal consequences and damage to professional reputation.[64]

Staying informed about current laws and regulations, engaging in continuous professional development, and implementing risk management strategies are crucial steps to mitigate legal risks and minimise professional liability. To safeguard against potential legal claims, dentists should secure professional indemnity insurance, which covers compensation claims and associated legal expenses. In South Africa, although not legally mandated, such insurance is crucial for protecting practitioners from financial risks arising from malpractice allegations.

Conclusions

Ethically responsible implant dentistry is a cornerstone of modern dental practice, rooted in the duty to provide safe, effective, and patient-centred care. The importance of ethical practice lies not only in achieving clinical success but in upholding the patients' best interests, patient autonomy, trust, and well-being throughout the treatment journey. Implant dentistry involves invasive procedures, long-term implications, and financial investment, making ethical integrity and clinical responsibility essential from the outset.

Clinicians must possess sound evidence-based knowledge and refined technical competencies, including a deep understanding of anatomy, biomaterials, surgical protocols, prosthetic planning, potential risks and complications and their prevention and management. Dental professionals must also stay updated on advancements in diagnostic tools, surgical techniques, and implant materials to enhance patient safety and outcomes. However, technical proficiency alone is insufficient. These skills and emerging technologies must be exercised with ethical sensitivity and professional accountability to ensure the best possible outcomes for diverse patient populations.

Comprehensive pre-surgical assessment and individualised risk analysis form the foundation of responsible care. Factors such as medical history, oral hygiene status, bone quality, lifestyle habits, and psychological readiness must be evaluated thoroughly. This risk-based planning ensures both patient safety and realistic outcome expectations.

Ethical implant dentistry demands clear and honest disclosure of treatment options, potential risks, costs, and alternatives. Informed consent is a continuous dialogue, not a single event, and should empower patients to make educated decisions about their care. Patients must never be pressured or misled, especially in elective procedures such as implant placement.

During the surgical phase, strict adherence to aseptic techniques and precision surgery is non-negotiable. Clinicians must manage intra-operative risks skilfully and anticipate potential complications, reinforcing the ethical obligation to "do no harm."

Postoperative care should be communicated and tailored to support healing and prevent complications. This includes pain control, infection prevention, and guidance on hygiene and nutrition. Ethical responsibility extends into the healing phase, ensuring patients are supported and monitored.

Long-term success depends on consistent maintenance and proactive monitoring. Ethically responsible care involves regular follow-ups, early management of peri-implant diseases, and updating patients on their oral health status. Preventive education and tailored recall intervals sustain implant function and oral health. Ethically responsible implant dentistry integrates clinical excellence with unwavering respect for patient rights, safety, and dignity. It requires a holistic, lifelong approach—anchored in transparency, professionalism, and patient-centred care at every stage of treatment. By integrating these strategies and innovations, dental practitioners can uphold the highest standards of care, ensuring safe and successful outcomes for their patients, enhance patient satisfaction, and strengthen professional reputation and trust.

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