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Review Article

Clinical decision and consideration of restorative dentistry

Tarik Mohammed Ali Alakkad[1]*, Rayed Mayah Alshammari[2], Sakinah Ali Alsaeed[3], Ali Jasim Al Sulail[4], Bushra Ali Alqahtani[5], Mohammed Abdullaziz AlShaikh[3], Razan Abdulrahman Abudeeb[6], Afnan Hassan Sayed[7], Saqer Nasser Alsubaie[6], Zeena Jafar[8], Abdulrahman Mohammed Alghamdi[9]

[1]Department of Restorative Dentistry, Al Thager Hospital, Jeddah, Saudi Arabia
[2]Dental Department, Hail Dental Center, Hail, Saudi Arabia
[3]General Dental Clinic, Primary Care, Al Ahsa Health Cluster Ministry of Health, Al Ahsa, Saudi Arabia
[4]Dental Department, Dammam Medical Complex, Dammam, Saudi Arabia
[5]Dental Department, Armed Forces Hospital Southern Region, Abha, Saudi Arabia
[6]College of Dentistry, King Saud University, Riyadh, Saudi Arabia
[7]College of Dentistry, Jazan University, Jazan, Saudi Arabia
[8]Dental Department, Dr. Abdulaziz Alajaji Dental Polyclinic, Khobar, Saudi Arabia
[9]College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

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***Correspondence:**
Dr. Tarik Mohammed Ali Alakkad,
E-mail: tm.akkad@gmail.com

ABSTRACT

Restorative dentistry is a rapidly evolving field dedicated to restoring oral health, function and aesthetics through innovative materials, techniques and patient-centered approaches. The integration of ethical and long-term considerations into clinical decision-making has become increasingly critical in ensuring sustainable and equitable care. Advances in restorative materials, such as nanocomposites and bioactive substances, have enhanced the durability, functionality and aesthetic outcomes of treatments. Adhesive technologies and minimally invasive approaches further prioritize the preservation of natural tooth structure while improving treatment longevity. Patient-centered treatment models, including shared decision-making (SDM) and motivational interviewing (MI), are reshaping how clinicians engage with patients. These frameworks emphasize collaboration, trust and behavioral changes, ensuring that clinical interventions align with individual preferences and lifestyles. Such approaches not only improve treatment adherence but also enhance patient satisfaction and long-term oral health. Ethical considerations in restorative care address issues like overtreatment, equitable access and informed consent. Balancing the demands of complex rehabilitations with patients' financial, psychological and systemic health factors ensures that restorative care remains sustainable and aligned with professional values. Additionally, proactive planning for long-term maintenance reduces the need for invasive interventions and extends the lifespan of restorations. Innovative techniques, such as the shortened dental arch concept and atraumatic restorative treatment, offer practical solutions in resource-constrained settings, contributing to a more inclusive approach to oral health care. By combining advancements in technology, patient-centered care and ethical practices, restorative dentistry continues to evolve, delivering effective, individualized and sustainable outcomes that improve the overall quality of life for diverse patient populations.

Keywords: Ethical considerations, Long-term maintenance, Minimally invasive techniques, Patient-centered care, Restorative dentistry

INTRODUCTION

Restorative dentistry plays an essential role in modern dental practice, focusing on the restoration of oral health, function and aesthetics. It encompasses a diverse range of procedures, from simple interventions like fillings and inlays to comprehensive treatments such as crowns, bridges and full-mouth rehabilitations. The field is dynamic, constantly shaped by advances in materials science, technology and clinical techniques, which have collectively elevated the standards of care delivered to patients. These innovations, combined with a growing emphasis on patient-centered care, enable clinicians to achieve outcomes that are both functionally durable and aesthetically pleasing.[1]

A key aspect of restorative dentistry is the complex clinical decision-making process, which demands a thorough understanding of each patient's needs and circumstances. Effective treatment planning involves not only addressing the immediate oral health issue but also anticipating long-term implications, such as structural durability, patient satisfaction and maintenance requirements. Dentists are required to carefully evaluate a variety of factors, including the extent of the damage, oral biomechanics, the patient's medical history and aesthetic preferences. This multifaceted approach ensures the selection of the most appropriate materials and techniques for each case. Furthermore, recent shifts in practice have embraced minimally invasive approaches, emphasizing the preservation of natural tooth structure wherever possible. Such practices are in alignment with ethical principles that prioritize the patient's long-term oral health over purely cosmetic or financially driven objectives.[2]

Technological advancements in the field of restorative dentistry have significantly transformed clinical workflows, making procedures more predictable and efficient. Computer-aided design and manufacturing (CAD/CAM) technologies, for instance, have revolutionized how restorations are designed and fabricated. By enabling the precise replication of tooth anatomy, CAD/CAM systems improve the fit, function and esthetic integration of restorations. This technology not only reduces chairside time but also enhances patient comfort and satisfaction. Similarly, the development of bioactive materials, which have the ability to interact with the oral environment, represents a paradigm shift in restorative practices. These materials promote remineralization, resist bacterial adhesion and facilitate the healing of surrounding tissues, thereby improving the longevity of dental restorations.[3]

Despite these advancements, restorative dentistry continues to face significant challenges. For instance, the accessibility of advanced dental care is often limited by socioeconomic factors, as many patients struggle to afford comprehensive treatments. Furthermore, patient compliance and understanding of oral health play a critical role in determining long-term success. Ethical dilemmas frequently arise in cases where patients prioritize immediate aesthetic improvements over functional stability or when extensive procedures are recommended without fully considering conservative alternatives. Clinicians are tasked with navigating these challenges, ensuring that patient autonomy is respected while providing care that aligns with professional and ethical standards.[4] As the field evolves, restorative dentistry remains a cornerstone of oral health care, combining science, art and ethics. The integration of cutting-edge technologies, patient-centered approaches and evidence-based practices ensures that dental restorations not only meet but exceed patient expectations. This review aims to explore the complexities of clinical decision-making in restorative dentistry, emphasizing advancements in technology, patient-centric approaches and ethical considerations.

REVIEW

The decision-making process in restorative dentistry is guided by evidence-based criteria and clinical expertise to achieve optimal outcomes. One significant advancement has been the development of clinical guidelines for evaluating restorations, enabling a standardized approach to treatment planning and outcome assessment. According to Hickel et al, criteria for evaluating direct and indirect restorations have been updated to improve their clinical reliability and reproducibility. These criteria not only assist in assessing material performance but also aid in identifying the most suitable treatments for individual patients, factoring in both functionality and aesthetics.[5] In addition, recent discussions have emphasized the role of restoration repair and refurbishment as viable alternatives to full replacement.

Repairing restorations not only minimizes the loss of tooth structure but also extends the lifespan of existing restorations, aligning with principles of minimally invasive dentistry. Hickel, Brüshaver and Ilie highlight the importance of decision-making frameworks that incorporate both clinical and patient-specific considerations when determining whether to repair or replace restorations. These frameworks emphasize the preservation of healthy tooth structure while addressing functional and esthetic needs, which underscores the evolving philosophy of conservative dentistry.[6] Together, these approaches reflect a paradigm shift toward evidence-based, patient-centered decision-making in restorative dentistry, ensuring sustainable and ethical dental care.

Advances in restorative materials and techniques

The advancements in restorative dentistry are largely driven by innovations in materials science and clinical techniques, which have significantly improved the quality and longevity of dental treatments. Direct composite restorative materials have undergone considerable

enhancement, with the introduction of nanotechnology playing a pivotal role. Puckett et al. highlight that nanocomposites exhibit superior mechanical properties, including increased wear resistance and reduced polymerization shrinkage. These improvements allow composites to better withstand the functional demands of the oral environment, especially in load-bearing areas, while providing aesthetically pleasing outcomes.[7]

Bioactive materials represent another significant innovation, offering restorative options that actively promote oral health. These materials, such as bioactive glass and calcium silicate-based cements, interact with the surrounding tooth structure to facilitate remineralization and tissue regeneration. Stansbury and Cramer emphasize that bioactive materials not only restore function but also contribute to the long-term preservation of natural teeth by reducing the risk of secondary caries and enhancing the overall health of the oral environment.[8] Adhesive technologies have also transformed restorative dentistry by enabling minimally invasive procedures.

The evolution of bonding agents, from simple acid-etch systems to advanced multi-step adhesives, has greatly improved the strength and durability of the bond between the restorative material and the tooth structure. Tyas and Burrow discuss how modern adhesives create reliable interfaces that preserve more of the natural tooth structure while providing strong resistance to microleakage and debonding. This advancement has allowed clinicians to shift toward more conservative treatment strategies without compromising restoration longevity.[9]

In addition to adhesives, advancements in resin composites have further enhanced the scope of restorative treatments. Resin composites have evolved to include improved polymer matrices and filler technologies, which contribute to their mechanical strength and esthetic properties. Khurshid et al. describe how the integration of nanoparticles into these materials has increased their translucency and color-matching capabilities, allowing for restorations that blend seamlessly with the surrounding dentition. The use of nanocomposites also reduces the likelihood of staining and wear, ensuring a durable and visually appealing restoration.[10]

Another notable development is the refinement of glass ionomer cements, which are widely used for their fluoride-releasing properties and chemical bonding capabilities. Modern formulations of glass ionomers combine the benefits of fluoride release with enhanced mechanical properties, making them suitable for a broader range of restorative applications. These materials are particularly beneficial in cases involving high caries risk, as they contribute to remineralization and provide a cariostatic effect. Pini et al. observe that advancements in these cements have extended their use beyond temporary restorations to include more permanent applications, especially in pediatric and geriatric dentistry.[11] Further innovation can be seen in atraumatic restorative treatment (ART) techniques, which utilize adhesive and bioactive materials to address dental needs in minimally invasive ways. This approach is especially beneficial in resource-limited settings, where traditional restorative methods may not be feasible. The use of these materials in ART not only restores function but also promotes oral health by reducing the microbial burden and encouraging natural healing processes. These developments in restorative materials and techniques exemplify the ongoing efforts to improve clinical outcomes while addressing patient-specific needs. By integrating advanced materials with evolving clinical practices, restorative dentistry continues to progress toward more effective, durable and patient-centered care.

Patient-centered approaches in treatment planning

Patient-centered care in restorative dentistry emphasizes the integration of a patient's preferences, needs and values into every stage of treatment planning. This approach requires clinicians to move beyond the traditional, disease-centric model and incorporate factors such as the patient’s quality of life, aesthetic desires and psychological comfort into clinical decisions.

The shared decision-making (SDM) model is a fundamental framework in patient-centered restorative dentistry, emphasizing collaboration between the patient and clinician. This approach fosters a dynamic dialogue where patients actively participate in treatment planning, ensuring their preferences and values are integrated into clinical decisions. Goldstein and Rich describe SDM as particularly valuable in prosthetic rehabilitation, where multiple treatment options are often available, such as fixed versus removable prostheses or minimally invasive versus extensive restorative approaches. By presenting patients with a clear understanding of the risks, benefits and potential long-term outcomes of each option, clinicians empower them to make informed choices. For example, a patient prioritizing aesthetics over cost may lean toward ceramic restorations, whereas another focused-on durability may opt for metal-supported prostheses.

The SDM model ensures these priorities are considered, preventing misaligned expectations. Additionally, it enhances patient autonomy by enabling them to weigh their choices against clinical recommendations. Beyond individual procedures, SDM facilitates transparency in complex, multi-phase treatments, fostering trust and a strong clinician-patient relationship. This alignment not only leads to higher satisfaction but also improves adherence to treatment plans, as patients are more likely to follow through with interventions, they helped shape.[12,13] The SDM model is particularly effective in managing cases with divergent options, such as balancing aesthetic goals with functional requirements. Patients undergoing full-mouth rehabilitations, for instance, can benefit significantly from understanding how different

materials, techniques and timelines align with their lifestyle and oral health goals. In this process, clinicians rely on their expertise to provide evidence-based insights, guiding patients through choices while respecting their autonomy. Studies have shown that SDM also enhances clinical outcomes by reducing dissatisfaction and miscommunication, as patients are fully aware of what to expect. The ongoing dialogue ensures that the evolving needs of the patient are addressed, making SDM a cornerstone of contemporary restorative practice.[14]

The motivational interviewing (MI) model is another patient-centered framework, focusing on behavioral change to enhance the outcomes of restorative dentistry. This model is particularly relevant for patients with lifestyle or behavioral factors contributing to oral health issues, such as bruxism, dietary habits or poor oral hygiene. Dietschi highlights the importance of MI in addressing cases of severe tooth wear, where long-term success often depends on modifying habits that could compromise restorations. Unlike traditional directive approaches, MI uses empathetic communication to encourage self-reflection and intrinsic motivation. Patients are guided to recognize their own role in maintaining oral health, which fosters a sense of ownership and responsibility for treatment success.[14,15]

The MI model operates through a collaborative dialogue where patients identify their challenges and goals while the clinician provides support and strategies for change. For example, in managing advanced caries or severe wear, the clinician might engage the patient in discussing the consequences of persistent habits like acidic beverage consumption or nocturnal bruxism. By allowing the patient to articulate these behaviors and their impact, MI helps patients develop a clearer understanding of their oral health. Additionally, the clinician uses open-ended questions and affirmations to reinforce the patient's capacity for change. In restorative contexts, this might involve guiding a patient to adopt preventive measures, such as the use of occlusal guards or fluoridated toothpaste, alongside restorative treatments like crowns or onlays.

What sets MI apart is its focus on internal motivation rather than external instruction. Patients are not merely told what to do, they are encouraged to explore the reasons behind their choices and commit to meaningful change. In restorative cases, this approach can prevent recurrence of issues that jeopardize restorations, such as secondary caries or restoration fractures. MI is particularly effective in pediatric and geriatric dentistry, where caregivers or older patients may require tailored guidance to support long-term oral health. Furthermore, MI complements restorative interventions by ensuring that patients actively participate in the maintenance and care of their restorations, reducing the likelihood of failure due to neglect or poor habits.[16] The combination of these patient-centered models-SDM for collaborative planning and MI for behavior-focused interventions—illustrates how restorative dentistry can integrate clinical expertise with the individual needs and preferences of patients. Both approaches emphasize communication, trust and shared responsibility, leading to more effective and sustainable dental care.

Ethical and long-term considerations in restorative care

Ethical considerations in restorative dentistry often revolve around the balance between achieving immediate clinical goals and ensuring long-term patient well-being. One central issue is the principle of autonomy, which requires that patients be fully informed about the risks and benefits of proposed treatments and alternative options. Moye et al, emphasize the need for transparency in cases where clinical interventions may have long-term implications, such as complex rehabilitations involving implants or extensive restorative procedures. Patients often face difficult decisions, particularly when invasive treatments carry risks of complications over time. Clinicians must avoid exerting undue influence or bias, instead fostering an environment where patients feel empowered to make decisions based on their values and priorities. This is particularly critical when dealing with elderly or incapacitated patients, where conflicts between ethical principles, such as autonomy and beneficence, may arise. Comprehensive communication and shared decision-making are essential in navigating these challenges, ensuring that patients' dignity and preferences are respected while pursuing optimal clinical outcomes.16

The concept of sustainability in restorative dentistry intersects with both ethical and long-term considerations. Witter et al, discuss the "shortened dental arch" (SDA) concept as a strategy for reducing the physical and financial burden of extensive restorative procedures. This approach prioritizes functionality and oral health overachieving a full dentition, recognizing that resource-intensive treatments may not always align with the patient's broader life circumstances. For example, a patient with systemic health challenges or financial limitations might benefit more from a well-designed SDA, which preserves essential masticatory functions while reducing the need for costly and invasive procedures. Clinicians must weigh the ethical implications of recommending extensive restorations that may not be sustainable or practical for the patient, particularly when long-term maintenance costs are considered. By adopting a pragmatic approach that focuses on the patient's quality of life and ability to manage ongoing care, practitioners can uphold ethical principles while delivering care that is both effective and realistic for the individual's circumstances.[17]

Long-term maintenance of restorative treatments introduces additional ethical complexities, particularly in managing progressive conditions such as periodontal disease or the consequences of wear and aging. Jepsen et al, emphasize the importance of proactive planning for long-term care during the initial treatment phase. For

instance, choosing materials and techniques that allow for easier repair or adjustment in the future aligns with ethical practices, as it minimizes the need for invasive interventions down the line. However, these decisions often require clinicians to make judgments about the patient's ability to adhere to maintenance protocols, such as regular cleanings or wearing protective appliances. Ethical dilemmas may arise when a patient's noncompliance jeopardizes the longevity of a restoration, forcing the clinician to consider whether to invest in further interventions. These scenarios underscore the necessity of open, ongoing communication between the dentist and the patient, fostering a shared understanding of the responsibilities required to ensure successful outcomes over time.[18]

The integration of minimally invasive techniques also aligns with ethical principles by prioritizing the preservation of natural tooth structure. Smales et al, explore the role of atraumatic restorative treatment (ART) as an alternative to conventional restorative methods. ART minimizes the removal of healthy tooth material while providing functional restorations, making it particularly suitable for patients in underserved or resource-limited settings. Ethical considerations in these cases extend beyond the individual patient to encompass broader societal responsibilities, such as addressing disparities in access to care. By incorporating ART and similar techniques into clinical practice, dentists can contribute to a more equitable distribution of resources while maintaining high standards of care for patients with diverse needs.[19]

Lastly, ethical decision-making in restorative care often involves balancing individual patient needs with professional and societal obligations. Politis et al, highlight the importance of evidence-based protocols to guide treatment planning, ensuring that interventions are not only clinically effective but also ethically justifiable. For example, clinicians must avoid overtreatment, which can lead to unnecessary costs and potential harm, while also ensuring that patients do not receive suboptimal care due to cost constraints. Ethical frameworks that prioritize patient-centered outcomes and equitable access to care are essential for navigating these complexities and delivering restorative treatments that are both sustainable and aligned with professional values.[20-23]

CONCLUSION

In restorative dentistry, ethical and long-term considerations are central to ensuring sustainable, patient-centered care. Balancing clinical effectiveness with respect for patient autonomy, access and maintenance challenges highlights the complexity of treatment planning. Incorporating minimally invasive techniques and proactive long-term strategies fosters equitable and durable outcomes. By adhering to these principles, restorative dentistry advances as both a science and a practice rooted in ethical integrity.

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