ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://ijrsms.com

International Journal of Recent Surgical and Medical Sciences

Narrative Review

Current Updates and Future Prospects of Periodontology in India

Vineet Kapoor[1]

[1]Department of Dentistry, Cures 'n' Care Dental Clinic, Ghaziabad, Uttar Pradesh, India

***Corresponding author:**
Dr. Vineet Kapoor,
Department of Dentistry,
Cures 'n' Care Dental Clinic,
Ghaziabad, Uttar Pradesh,
India.

vineetcochin@gmail.com

Received: 20 January 2025

Accepted: 21 January 2025

Published: 12 February 2025

DOI
10.25259/IJRSMS_5_2025

Quick Response Code

INTRODUCTION

The modern era of dentistry has witnessed remarkable advancements and transformative updates over the past decade. Periodontology, a specialized branch of dentistry, focuses on understanding the biology of the supporting structures of teeth, as well as the pathophysiology, diagnosis, and treatment of diseases affecting these structures.[1] Our understanding of the pathophysiology of periodontal diseases has significantly advanced over the last few decades. However, numerous questions remain unanswered, requiring robust and substantial evidence to address them effectively.

In the last few decades, significant advancements have been made in the understanding of the pathophysiology of periodontal diseases, as well as in the diagnosis, treatment planning, and particularly in the development of minimally invasive periodontal surgeries. More recently, advancements in nanotechnology, 3D printing, and Artificial Intelligence (AI) have brought about significant improvements in the diagnosis, treatment planning, and outcomes of periodontal disease management. Looking ahead, these technologies hold the potential to revolutionize periodontal care, offering more precise, personalized, and minimally invasive approaches to treatment.

Significant advancements in knowledge about periodontal diseases over the past decade have led to the development and adoption of the New Classification System for Periodontal Diseases.[2] A globally adopted, uniform classification system for periodontal diseases is expected to enhance our understanding, facilitating seamless communication and consistency in data collection. However, in a rapidly developing country like India, one of the key challenges lies in the standardization and systematic recording of data. It is crucial to emphasize the importance of comprehensively understanding the new classification system and implementing it consistently across all levels of dental care, from primary healthcare centers to multispecialty dental hospitals.

Recent advancements in clinical diagnosis

Beyond the conceptual understanding of periodontal diseases, significant advancements have been achieved in their clinical and radiographic diagnosis. Accurate diagnosis of periodontal diseases primarily relies on key parameters, including the precise estimation of bleeding on probing (BOP), pocket depth (PD), clinical attachment level (CAL), and radiographic assessment of periodontal bone loss.[3] Manual probing errors can lead to inaccurate measurements, potentially resulting in misdiagnosis and suboptimal treatment outcomes.[4] In recent decades, the use of pressure-sensitive probes has emerged as a valuable tool, enabling more accurate and consistent assessment of BOP, PD, and CAL.[5]

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.
©2025 Published by Scientific Scholar on behalf of International Journal of Recent Surgical and Medical Sciences

Traditionally, ionizing 2D imaging techniques such as intraoral periapical radiographs (IOPAR), bitewing radiographs, and orthopantomographs (OPG) have been utilized for the assessment of bone loss in patients with periodontitis. In recent years, cone-beam computed tomography (CBCT) has gained recognition as a 3D imaging modality for evaluating bone loss. While its routine use in periodontal diagnosis is not universally endorsed, CBCT may offer valuable insights when combined with 2D imaging and clinical probing.[6] CBCT is particularly relevant in cases of advanced periodontal disease with coexisting endodontic involvement or for patients being evaluated for dental implant placement.[7]

Recently, soft tissue CBCT (ST-CBCT) has emerged as an alternative tool for assessing gingival dimensions, offering valuable applications in both perioplastic treatments and dental implant planning.[8,9] Non-ionizing imaging modalities such as magnetic resonance imaging (MRI), ultrasound, and optical coherence tomography (OCT) have emerged as advanced techniques, offering unique advantages in the visualization and assessment of soft tissues related to periodontal structures.[6,10] Nevertheless, additional studies are necessary to determine their definitive diagnostic utility in periodontal evaluation, especially due to the limited availability of clinical evidence.

Recent advancements in tissue engineering

The field of periodontal regeneration has witnessed remarkable innovations driven by a deeper understanding of tissue engineering principles. The tissue engineering approach to bone and periodontal regeneration involves the integration of three fundamental components: progenitor cells, which act as the foundation for new tissue formation; a scaffold or supporting matrix, providing the structural framework necessary for cell attachment, growth, and organization; and signaling molecules, which regulate and stimulate cellular processes critical for tissue repair and regeneration.[11] The utilization of vectors for the delivery of growth factors and proteins has heralded a transformative shift in the field of periodontology. Growth factors such as rhBMP-2, PDGF-α, and TGFβ have been extensively studied and widely utilized in the context of periodontal regeneration.[12,13]

Recent advancements in 3D printing

Modern digital dentistry is indispensable, with 3D scanning and printing serving as essential technologies in advancing precision and efficiency. Real-time 3D scanning with digital scanners enables clinicians to effectively educate patients about dental issues, fostering greater understanding and motivating timely dental treatment.[14] In addition, these 3D scans play a crucial role in treatment planning and execution, particularly in dental implants and periodontal regeneration, ensuring greater precision.[15,16] Recently, 3D scaffolds embedded with growth factor proteins have been utilized to deliver these factors within a customized structure, optimizing regeneration outcomes.[15] Furthermore, 3D printing of surgical stents has proven to offer superior accuracy compared to traditional thermoplastic stents, enhancing the precision of dental procedures.[17]

Recent advancements in minimally invasive periodontal surgery

Significant breakthroughs have been made in periodontal surgery, particularly in the areas of periodontal regeneration and aesthetic procedures. The incorporation of Minimally Invasive Surgery (MIS) principles in the field of periodontology has led to remarkable improvements in both surgical outcomes and post-operative patient comfort.[18] Additionally, the use of loupes and surgical microscopes has further enhanced surgical precision, ensuring better results while adhering to the principles of MIS.

Recent advancements in nanotechnology

Nanotechnology can be defined as 'the science and engineering involved in the design, synthesis, characterization, and application of materials and devices whose smallest functional organization, in at least one dimension, is on the nanometer scale or one billionth of a meter.'[19] Nanoparticles are being explored for localized drug delivery[20], while nanorobots hold promise for applications such as oral pain relief and targeted drug administration. Bioactive glass, carbon nanomaterials, titanium nanotube-coated dental implants, and nanoceramics play a crucial role in bone regeneration and are also used to create scaffolds for regenerating the periodontium.[21]

Recent advancements in artificial intelligence

AI refers to 'the simulation of human intelligence in machines that are programmed to think and learn like humans.' In periodontics, AI applications are designed to assist dental professionals in treatment planning, diagnosis, and prediction of treatment outcomes".[22] Presently, AI tools have been extensively studied in periodontal diagnosis, especially in estimation of bone loss in radiographs. Panoramic radiographs, coupled with convolutional neural networks, an AI tool, have detected periodontal bone damage with results comparable to those of experienced clinicians.[23]

Ethical approval: Institutional Review Board approval is not required.
Declaration of patients consent: Patient's consent not required as there are no patients in this study.
Financial support and sponsorship: Nil.
Conflicts of interest: There are no conflicts of interest.
Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no

use of artificial intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Mariotti A, Hefti A. Defining Periodontal Health. BMC Oral Health 2015;15:S6.
2. Caton JG, Armitage G, Berglundh T, Chapple ILC, Jepsen S, Kornman KS, *et al*. A New Classification Scheme for Periodontal and Peri-implant Diseases and Conditions – Introduction and Keychanges from the 1999 Classification. J Clin Periodontol 2018;45:S1–8.
3. Ramenzoni L, Lehner M, Kaufmann M, Wiedemeier D, Attin T, Schmidlin P. Oral Diagnostic Methods for the Detection of Periodontal Disease. Diagnostics (Basel) 2021;11:571.
4. Rajkhowa C, Waikhom N, Sivasarankumar S. Comparative Evaluation of Pocket Depth Measurement by using Two Different Periodontal Probes. Int J Oral Health Dent 2023;9:28-31.
5. Tripathi P, Puri K, Kumar A, Khatri M, Bansal M, Rehan M. Comparison of Two Different Probing Systems for Evaluation of Bleeding on Probing (BOP). IP Int J Periodontol Implantol 2021;6:157-60.
6. Jacobs R, Fontenele RC, Lahoud P, et al. Radiographic Diagnosis of Periodontal Diseases – Current Evidence Versus Innovations. Periodontol 2000 2024;95:51-69.
7. Mandelaris GA, Scheyer ET, Evans M, Shujaat S, Bornstein MM. American Academy of Periodontology Best Evidence Consensus Statement on Selected Oral Applications for Cone Beam Computed Tomography. JPeriodontol 2017;88:939-45.
8. Ravindran N, Sudhakar U, Mithradas N, Suresh S, Lakshmi K, Steffy J. Gingival Tissue Evaluation using Soft Tissue-cone-Beam Computed Tomography and Root Coverage Esthetic Score in the Treatment of Isolated Gingival Recession: A Clinical Study. J Indian Soc Periodontol 2024;28:312-8.
9. Singh N, Rajesh N, Ramesh A. Assessment of Implant Stability with Resonance Frequency Analysis and Changes in the Thickness of Keratinized Tissue and Crestal Bone Level using Cone-beam Computed Tomography in Two-stage Implants: A Three-dimensional Clinicoradiographic Study. J Indian Soc Periodontol 2024;28:368-75.
10. Juerchott A, Sohani M, Schwindling FS, et al. In Vivo Accuracy of Dental Magnetic Resonance Imaging in Assessing Maxillarymolar Furcation Involvement: A Feasibility Study in Humans. J Clin Periodontol 2020;47:809-15.
11. Galli M, Yao Y, Giannobile W, Wang H. Current and Future Trends in Periodontal Tissue Engineering and Bone Regeneration. Plast Aesthet Res 2021;8:3.
12. Garg S, Kapoor R, Tyagi P, Wadhawan A. Treatment of Human Intraosseous Periodontal Defects using Recombinant Human Bone Morphogenetic Protein-2: A Randomized Controlled Clinical Trial. Cureus 2023;15:e40395.
13. Thakare K, Bhongade M, Charde P, Jaiswal P, Shah N, Deshpande A. Periodontal Regeneration using Platelet-derived Growth Factor in Infrabony Defects: A Series of Three Cases. Case Rep Dent 2013;2013:849823.
14. Mahesh Batra A, Reche A. A New Era of Dental Care: Harnessing Artificial Intelligence for Better Diagnosis and Treatment. Cureus 2023;15:e49319.
15. Verykokou S, Ioannidis C, Soile S, Angelopoulos C, Theodoridis K, Arampatzis A, *et al*. The Role of Cone Beam Computed Tomography in Periodontology: From 3D Models of Periodontal Defects to 3D-Printed Scaffolds. J Pers Med 2024;14:207.
16. Saini R, Bavabeedu S, Quadri S, Gurumurthy V, Kanji M, Kuruniyan M, *et al*. Impact of 3D Imaging Techniques and Virtual Patients on the Accuracy of Planning and Surgical Placement of Dental Implants: A Systematic Review. Digit Health 2024;10:20552076241253550.
17. Husain F, Grover V, Bhaskar N, Jain A. Comparative Evaluation of Accuracy of Implants Placed with Thermoplastic and Three-dimensional-printed Surgical Guides: A Randomized Controlled Trial. J Indian Soc Periodontol 2024;28:244-51.
18. Harrel S, Rees T. Granulation Tissue Removal in Routine and Minimally Invasive Procedures. Compend Contin Educ Dent 1995;16:960.
19. Saini R, Saini S, Sharma S. Nanotechnology: The Future Medicine. J Cutan Aesthet Surg 2010;3:32-3.
20. Madhumathi K, Rubaiya Y, Doble M, Venkateswari R, Sampath Kumar T. Antibacterial, Anti-inflammatory, and Bone-regenerative Dual-drug-loaded Calcium Phosphate Nanocarriers-in Vitro and in Vivo Studies. Drug Deliv Transl Res 2018;8:1066-77.
21. Devisha D, Singh DK, Sarkar S. Recent Advancement in Periodontics. Int J Sci Nat 2019;10:1-10.
22. Parihar AS, Narang, Tyagi S, Narang S, Narang A, Dwivedi S, Katoch V, *et al*. Artificial Intelligence in Periodontics: A. J Pharm Bioallied Sci 2024;16:S1956-8.
23. Fidyawati D, Masulili S, Iskandar H, Suhartanto H, Soeroso Y. Artificial Intelligence for Detecting Periodontitis: Systematic Literature Review. Open Dent J 2024;18:e18742106279454.

How to cite this article: Kapoor V. Current Updates and Future Prospects of Periodontology in India. Int J Recent Surg Med Sci. 2025:11(e002). doi: 10.25259/IJRSMS_5_2025