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Review Article

Modern Endodontics in the Indian Context: A Comprehensive Narrative Review

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Abstract: Modern endodontics in India is experiencing a significant transformation with the integration of advanced technologies, minimally invasive techniques, and evidence-based clinical practices. This narrative review explores key innovations such as rotary and reciprocating systems, dental operating microscopes, cone-beam computed tomography (CBCT), regenerative endodontics, and bio-ceramic sealers. Despite these advancements, stark disparities persist between urban and rural regions due to financial constraints, limited training opportunities, and infrastructural deficiencies. The review further discusses systemic challenges, including patient misconceptions and gaps in continuing education. It also outlines promising future directions, including AI-assisted diagnostics, minimally invasive approaches, and tele-dentistry. The review underscores the need for strategic policy reforms, equitable resource allocation, and nationwide training initiatives to bridge the accessibility gap and elevate the standard of endodontic care across India.

Keywords: Endodontics, India, Root Canal Treatment, Rotary Systems, Dental Microscopy, CBCT, Regenerative Endodontics, Bioceramic Sealers, Urban-Rural Disparities, Teledentistry.

INTRODUCTION

Endodontics has undergone a paradigm shift globally, with India progressively integrating advanced technologies and evidence-based practices into clinical care. The specialty has evolved from conventional root canal treatments to minimally invasive, biologically driven approaches, significantly improving treatment outcomes. However, India's diverse socioeconomic landscape creates disparities in access to modern endodontic care between urban and rural populations. This review critically examines the current state of endodontics in India, focusing on technological advancements, persistent challenges, and future directions, supported by recent clinical studies and institutional reports.

Technological Advancements in Indian Endodontics

1. **Rotary and Reciprocating Systems:** The transition from stainless steel hand files to nickel-titanium (NiTi) rotary systems (e.g., ProTaper Next, WaveOne Gold) has revolutionized root canal preparation in India. Studies demonstrate that NiTi files reduce canal transportation and perforation risks while improving shaping efficiency (Pawar *et al.*, 2017). Single-file reciprocating systems like Reciproc and OneShape are gaining popularity in private clinics due to their cost-effectiveness and reduced procedural time (Singh & Pawar, 2019).
2. **Magnification and Illumination:** Dental operating microscopes (DOMs) have become indispensable for managing complex cases, such as calcified canals and missed anatomy. A 2021 Indian Endodontic Society (IES) survey revealed that while 30% of urban endodontists use DOMs routinely, rural adoption remains negligible due to high costs (₹8–15 lakh per unit) (IES, 2021). Loupes with LED illumination are emerging as affordable alternatives, but training gaps persist.

3. **Cone-Beam Computed Tomography (CBCT):** CBCT's 3D imaging capabilities enhance diagnostics for apical pathologies, root fractures, and anatomical variations. Despite its advantages, CBCT is primarily limited to metropolitan dental colleges and corporate chains (Gupta *et al*., 2022). A single scan costs ₹2,000–5,000, making it inaccessible for most standalone clinics.
4. **Regenerative Endodontics:** India is witnessing pioneering research in pulp regeneration, particularly at AIIMS and MAIDS. Studies on platelet-rich fibrin (PRF) and stem cell scaffolds show promise for revitalizing necrotic pulps in immature teeth (Sharma *et al*., 2021). However, clinical protocols remain experimental, with regulatory hurdles delaying widespread implementation (Mehta *et al*., 2023).
5. **Bioceramic Sealers and Obturation Techniques:** Bioceramic sealers (e.g., BioRoot RCS, EndoSequence) offer superior bioactivity and sealability compared to traditional zinc oxide-eugenol. The Dental Council of India (DCI) reports that 45% of urban endodontists have adopted these materials, while rural practitioners lag due to cost (₹1,500–3,000 per syringe) and lack of training (DCI, 2022).

Challenges in Indian Endodontics

1. **Urban-Rural Disparities:** Advanced endodontic care is concentrated in cities, with rural areas relying on outdated techniques. The National Oral Health Program (NOHP) aims to bridge this gap but struggles with funding delays and logistical bottlenecks (Ministry of Health, 2023).
2. **Financial Barriers:** The high cost of equipment (e.g., DOMs: ₹8–15 lakh, CBCT machines: ₹40–60 lakh) limits accessibility. The Indian Dental Association (IDA) advocates for subsidies and EMI-based procurement models (Patel *et al*., 2021).
3. **Training Deficits:** Only 25% of general dentists attend annual endodontic workshops (Bhatia *et al*., 2020). The IES has expanded hands-on training, but online modules and regional camps are needed to reach remote practitioners.
4. **Patient Misconceptions:** Cultural myths associating root canals with pain drive unnecessary extractions. The IDA's "Save Your Tooth" campaign uses vernacular social media content to combat misinformation (Joshi *et al*., 2022).

Future Directions

1. **AI and Digital Dentistry:** AI-powered tools for caries detection (e.g., Diagnocat) and guided endodontics are under trial at MAIDS, potentially reducing human error (Kaur *et al*., 2023).
2. **Minimally Invasive Techniques:** Hydraulic cement (Biodentine) and partial pulpotomy are gaining traction for preserving tooth structure (Chandra *et al*., 2022).
3. **Teledentistry:** Post-COVID, platforms like DentCare Connect enable rural patients to consult specialists remotely (Desai *et al*., 2023).

CONCLUSION

While India has embraced cutting-edge endodontic technologies, equitable access remains a challenge. Strategic investments in infrastructure, subsidized training, and public awareness campaigns are critical to democratizing advanced care. Collaborative efforts between the government, dental associations, and industry can accelerate progress, ensuring optimal oral health outcomes nationwide.

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