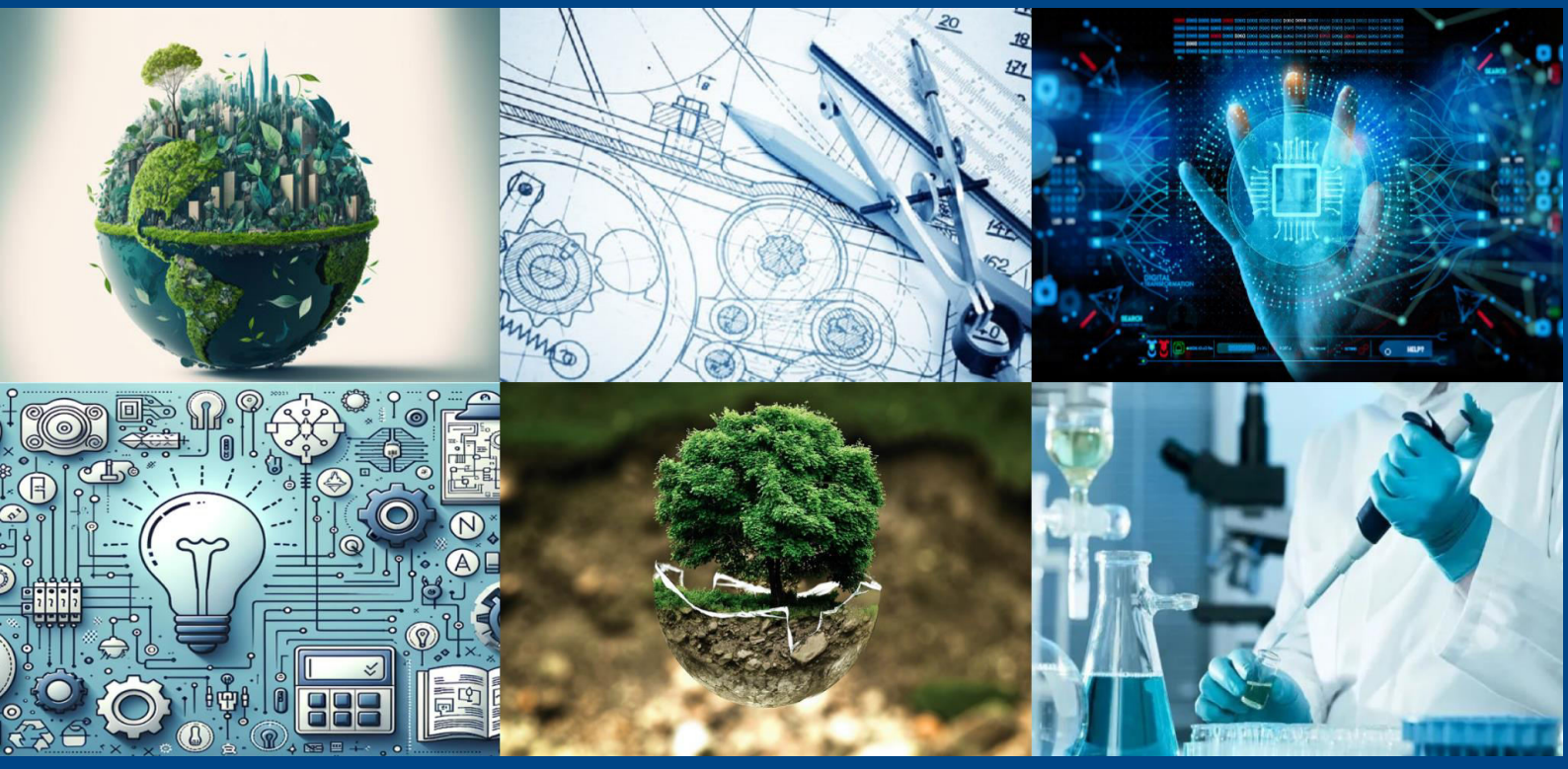
ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206 **Volume 8, Issue 8, August 2025**

© 2025 IJMRSET | Volume 8, Issue 8, August 2025| DOI:10.15680/IJMRSET.2025.0808034

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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GuttaFlow Bioseal as a Bioceramic Root Canal Sealer: Clinical Insights from a Case Series

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ABSTRACT: Successful root canal treatment relies on thorough cleaning, shaping, and hermetic sealing of the root canal system to prevent reinfection and promote periapical healing. GuttaFlow Bioseal (Coltene), a bioceramic sealer, combines excellent sealing properties with bioactive potential to support tissue regeneration.

This case series presents endodontic treatments performed with GuttaFlow Bioseal, emphasizing its clinical handling, sealing ability, and potential to enhance periapical healing. The series included primary treatments, retreatments, and teeth with complex canal anatomies. Following standardized cleaning and shaping protocols, obturation was carried out using the cold free-flow technique with GuttaFlow Bioseal. In all cases, the material demonstrated excellent flow and adaptation to canal walls and intricate anatomical spaces. Radiographic follow-ups revealed favourable periapical healing without evidence of adverse reactions.

Within the limitations of this case series, GuttaFlow Bioseal proved to be a user-friendly, bioactive obturation material that ensures effective sealing and promotes periapical healing. Its use can be recommended across diverse endodontic scenarios.

KEYWORDS: Bioceramics, Endodontic therapy, Endodontic sealers, Gutta Flow Bioseal, Gutta percha, Root Canal System.

I. INTRODUCTION

The primary goal of root canal obturation is to achieve a three-dimensional, hermetic seal of the prepared radicular space, thereby preventing microbial reinfection and promoting healing of periapical tissues.[1] Traditional obturation techniques employing gutta-percha in combination with conventional sealers have been widely accepted in clinical practice. However, these materials often present limitations, including polymerization shrinkage, solubility, and vulnerability to microleakage, particularly in cases of compromised coronal sealing. Such shortcomings may adversely affect the long-term prognosis of endodontic treatment [2].

Recent advances in material science have introduced bioceramic-based sealers, which represent a significant leap forward in endodontic obturation technology. These sealers are bioactive, biocompatible, and dimensionally stable. Their ability to chemically bond with dentin, release calcium ions, and promote hydroxyapatite formation provides an enhanced biological seal compared to conventional sealers. Moreover, their antibacterial activity in an alkaline environment and capacity to stimulate hard tissue regeneration further support their clinical advantages [3].

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GuttaFlow Bioseal (Coltene, Switzerland) is a novel, cold, free-flow obturation system that combines finely ground gutta-percha particles with a silicone matrix enriched with calcium silicate and bioactive glass. This unique formulation not only ensures superior flow and adaptation to intricate canal morphologies but also facilitates the nucleation of hydroxyapatite crystals upon contact with tissue fluids [4,5]. Such bioactivity fosters a biologically integrated seal along the dentinal walls, while simultaneously creating a favorable environment for periapical tissue healing.

Collectively, these properties make GuttaFlow Bioseal a promising obturation material, merging the mechanical benefits of gutta-percha with the bioactive potential of bioceramic sealers. Its handling simplicity, flowability, and regenerative potential highlight its versatility and suitability across a wide range of endodontic cases.
This case series highlights the use of GuttaFlow Bioseal in primary treatments, retreatments, and cases with challenging canal anatomies, emphasizing its handling characteristics, sealing ability, and potential to support periapical healing.

GuttaFlow Bioseal: The Material Science

A. Composition

GuttaFlow Bioseal is a silicone-based, bioactive root canal obturation material that integrates gutta-percha powder with a bioactive glass-containing matrix (Fig 1). Its composition provides dimensional stability, radiopacity, and bioactivity, distinguishing it from conventional sealers (Table 1). This synergistic formulation results in a bioceramic-enhanced obturation material with superior handling characteristics and enhanced biological interaction compared to traditional sealers.

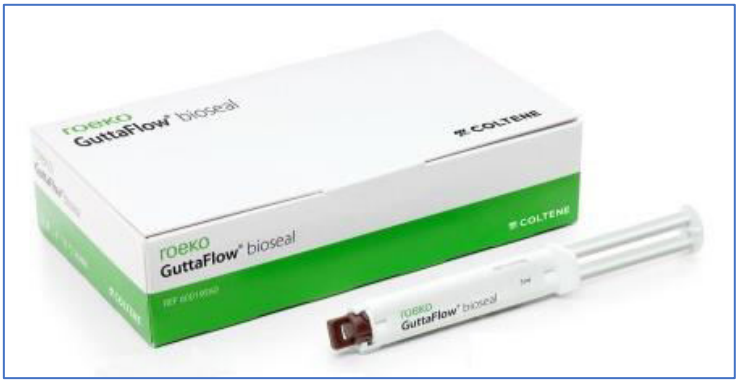

Fig1: GuttaFlow Bioseal (Coltene, Switzerland)

Table 1. Composition of GuttaFlow Bioseal

Component	Function
Polydimethylsiloxane	Silicone base; provides dimensional stability and flexibility
Gutta-percha powder	Contributes to the obturating mass
Bioactive glass	Initiates hydroxyapatite precipitation and bioactivity
Zirconium dioxide	Radiopacifier
Pigments & inert fillers	Provide color stability and consistency
Platinum catalyst	Assists polymerization reaction

B. Physical and Handling Properties

GuttaFlow Bioseal is supplied in a dual-chamber syringe, ensuring consistent mixing via a disposable tip. It is intended for cold obturation, with a working time of approximately 5 minutes and a setting time of 12–16 minutes under clinical conditions. The material exhibits thixotropic behavior, meaning it flows readily under pressure, facilitating penetration into fine canal irregularities such as isthmuses, lateral canals, and fins. This property enhances adaptation and sealing ability (Table 2).

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Table 2. Physical Properties of GuttaFlow Bioseal (ISO 6876 standards)

Property	Value/Specification
Film thickness	≤ 50 µm
Solubility	≤ 1.29%
Adhesion to dentin	3 MPa
Radiopacity	≥ 3 mm Al
Solubility after setting	Nearly insoluble
Storage conditions	18–24°C

C. Bioactivity and Healing Potential

Unlike traditional sealers, GuttaFlow Bioseal exhibits true bioactivity. On contact with dentinal fluids, it releases calcium and phosphate ions, resulting in in-situ hydroxyapatite crystal formation on the material surface [6]. This process promotes chemical bonding with dentin, ensuring a long-term seal and creates a biologically favorable environment for periapical tissue healing.

D. Clinical Advantages

The combined physicochemical and biological properties of GuttaFlow Bioseal translate into distinct clinical benefits (Table 3).

Table 3. Clinical Advantages of GuttaFlow Bioseal

Advantage	Clinical Implication
Enhanced sealing	Prevents apical and coronal microleakage
Bioactive mineral deposition	Promotes periapical healing
Balanced expansion	Improves adaptation to dentin walls
Efficient retreatability	Facilitates endodontic re-intervention when required
Short setting time (12–16 min)	Allows same-visit post placement
Superior flow behavior	Adapts to complex anatomies (isthmuses, lateral canals, fins)

These features make GuttaFlow Bioseal a versatile obturation material, suitable for primary root canal treatments, retreatments, and anatomically challenging cases.

II. CASE REPORTS

Case 1: Non-surgical Primary Endodontic Therapy of Maxillary Right First Molar with 2 palatal canals

A 43-year-old male patient presented with the chief complaint of radiating pain in the upper right posterior region for the past 10 days, associated with occasional food lodgement. The pain was intermittent, exacerbated by mastication, and relieved temporarily with over-the-counter analgesics. The patient's medical history was non-contributory.

Clinical Examination: Intraoral examination revealed deep distal caries in tooth #16 (maxillary right first molar). The tooth was tender on vertical percussion, with no abnormal mobility. The surrounding gingival tissues appeared healthy (Figure 2).

Radiographic Examination: A periapical radiograph demonstrated carious involvement extending into the pulp chamber, with widening of the periodontal ligament space surrounding the palatal and distobuccal roots. Based on clinical and radiographic findings, the diagnosis was established as symptomatic irreversible pulpitis with symptomatic apical periodontitis.

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Treatment Protocol: Local anaesthesia was administered using 2% lignocaine with 1:100,000 epinephrine, and the tooth was isolated under rubber dam. Endodontic access was established using a high-speed round diamond bur with water coolant, and refined with an Endo-Access bur (Coltene). Under magnification with dental loupes, the mesiobuccal (MB), distobuccal (DB), and two palatal canals (mesiopalatal [MP] and distopalatal [DP]) were identified. Initial canal negotiation was performed with #10 K-files, and working lengths were determined using an apex locator (CanalPro CL2i, Coltene) and verified radiographically. Cleaning and shaping were completed using Hyflex CM rotary instruments (Coltene) with copious irrigation of 5.25% sodium hypochlorite (Coltene), delivered with a side-vented needle and activated ultrasonically to optimize irrigant penetration. Apical preparation was standardized to size 25/04 for all canals (MB, DB, MP, DP). Final irrigation was performed with 17% EDTA (Coltene), for 1 minute to remove the smear layer alomg with its ultrasonic activation (CanalPro Endoactivator, Coltene) followed by a saline rinse. Canals were dried with sterile paper points.

Obturation: A cold free-flow obturation technique was employed using GuttaFlow Bioseal (Coltene). The material, dispensed through a dual-chamber syringe and mixing tip, ensured consistent mixing and uniform placement. Master gutta-percha cones were lightly coated with the sealer and seated to full working length. The thixotropic properties of GuttaFlow Bioseal facilitated optimal adaptation into canal irregularities, ensuring a homogenous three-dimensional seal. Excess gutta-percha was seared at the orifices and vertically compacted. The access cavity was subsequently restored with composite resin.

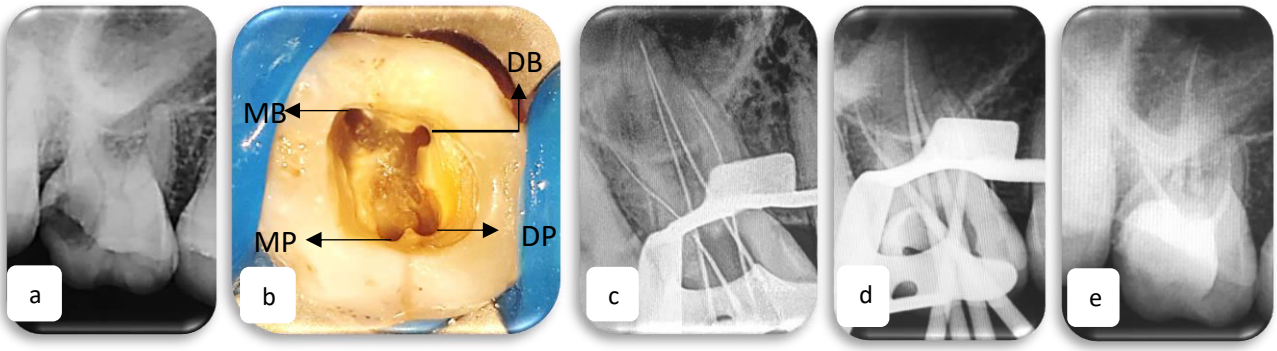

Figure 2: Non-surgical Primary Endodontic Therapy of Maxillary Right First Molar. a) Pre-operative Radiograph; b) Access Cavity Preparation; c) Working Length Radiograph; d) Master Cone Radiograph; e) Post-operative Radiograph.

Case 2: Non-surgical Primary Endodontic Therapy of Mandibular Right First Molar with Middle Mesial Canal
A 35-year-old male patient presented with pain in the lower right posterior region for one week, aggravated during mastication. Medical history was non-contributory.

Clinical Examination: Tooth #46 (mandibular right first molar) was previously restored and exhibited tenderness on vertical percussion. There was no associated swelling, sinus tract, or abnormal mobility.

Radiographic Examination: A preoperative periapical radiograph revealed radiolucency beneath the existing restoration, suggestive of secondary caries extending into the pulp space. Widening of the periodontal ligament space was evident around both mesial and distal roots. Based on these findings, the diagnosis was established as symptomatic irreversible pulpitis with symptomatic apical periodontitis (Figure 3).

Treatment Protocol: Following administration of 2% lignocaine with 1:100,000 epinephrine and rubber dam isolation, endodontic access was prepared as described in Case 1. The mesiobuccal (MB), mesiolingual (ML), and distal (D) canal orifices were located. Careful troughing of the developmental groove between MB and ML canals, under magnification, revealed the presence of an additional middle mesial canal (MMC).All canals (MB, ML, MMC, D) were negotiated with #10 K-files, and working lengths were established using an electronic apex locator and confirmed radiographically. Cleaning and shaping were performed using Hyflex CM rotary instruments (Coltene), with copious irrigation using 5.25% sodium hypochlorite activated ultrasonically. Final irrigation was carried out with 17% EDTA followed by sterile saline.

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Obturation: A cold free-flow obturation technique was employed using GuttaFlow Bioseal (Coltene). Master gutta-percha cones were lightly coated with sealer and seated to full working length in all canals, including the MMC. Excess gutta-percha was seared at the canal orifices and vertically compacted. The access cavity was subsequently restored with composite resin.

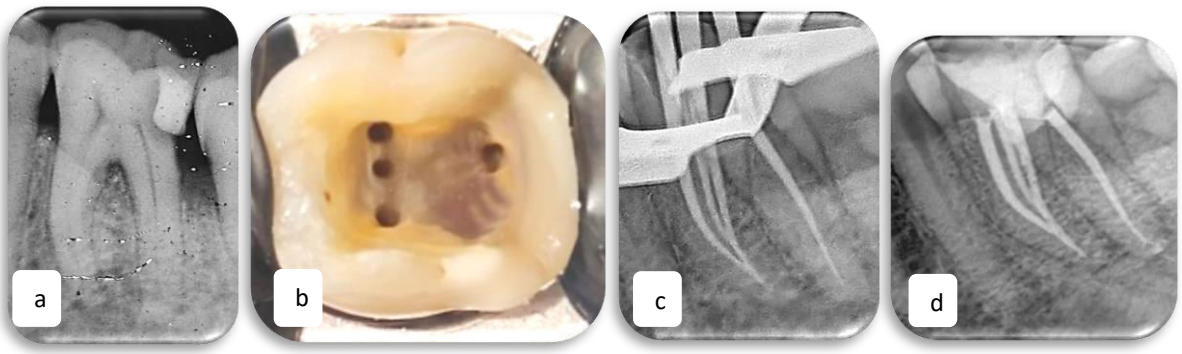

Figure 3: Non-surgical Primary Endodontic Therapy of Mandibular Right First Molar. a) Pre-operative Radiograph; b) Access Cavity Preparation; c) Master Cone Radiograph; d) Post-operative Radiograph.

Case 3: Non-surgical Endodontic Retreatment of Maxillary Right First Molar with Missed MB2 Canal

A 27-year-old male patient presented with discomfort in the upper right posterior region, particularly during mastication. The patient reported a history of root canal treatment in tooth #16 (maxillary right first molar) performed two years prior. The medical history was non-contributory.

Clinical Examination: Tooth #16 was restored with an intact composite restoration (Figure 4) and exhibited mild tenderness on vertical percussion. There was no swelling, sinus tract, or abnormal mobility.

Radiographic Examination: A preoperative periapical radiograph demonstrated a short obturation in the mesiobuccal canal, with a periapical radiolucency involving the mesiobuccal and palatal roots. Based on clinical and radiographic findings, the diagnosis was previously endodontically treated tooth with symptomatic apical periodontitis.

Treatment Protocol: Following administration of 2% lignocaine with 1:100,000 epinephrine and rubber dam isolation, the composite restoration was removed, and the access cavity was refined. Residual gutta-percha was retrieved using the HyFlex Remover file (Coltene) under continuous irrigation with 5.25% sodium hypochlorite. Under dental operating microscope (DOM) magnification, troughing with ultrasonic tips enabled identification of a previously untreated second mesiobuccal canal (MB2). Canal patency was established with #10 K-files, and working lengths were determined using an apex locator and confirmed radiographically. Cleaning and shaping were performed with HyFlex CM rotary instruments (Coltene), using an irrigation protocol consisting of 5.25% sodium hypochlorite activated ultrasonically, followed by 17% EDTA and a final saline rinse.

Obturation: Final obturation was performed using the cold free-flow technique with GuttaFlow Bioseal (Coltene). Master gutta-percha cones were lightly coated with sealer and seated to full working length in MB1, MB2, DB, and P canals. Excess gutta-percha was seared at the canal orifices and vertically compacted. The access cavity was restored with composite resin.

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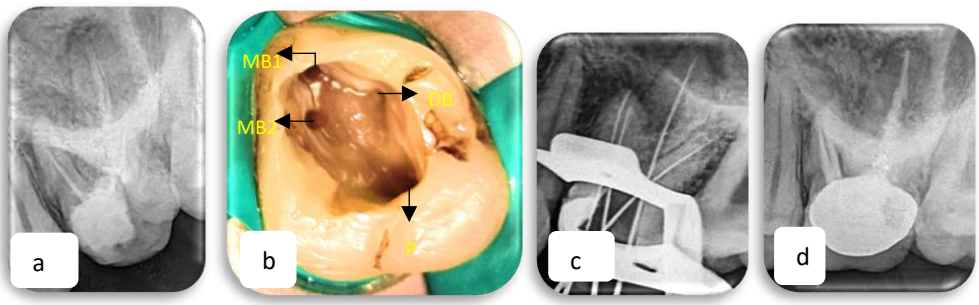

Figure 4: Non-surgical Endodontic Retreatment of Maxillary Right First Molar. a) Pre-operative Radiograph; b) Access Cavity Preparation; c) Working Length Radiograph; d) Post operative Radiograph.

The success of endodontic treatment is contingent on thorough debridement, disinfection, and three-dimensional obturation of the root canal system to prevent reinfection and facilitate periapical healing.[7] Conventional gutta-percha and sealer combinations, though widely employed, are limited by their inability to establish a biologically integrated seal with dentin and their susceptibility to microleakage in cases of compromised coronal or apical integrity. The introduction of bioactive sealers has significantly advanced endodontic obturation by combining sealing ability with regenerative potential.

In the present case series, GuttaFlow Bioseal was successfully employed in three clinical scenarios: primary treatment of a maxillary molar with complex canal anatomy; management of a mandibular molar with a middle mesial canal (MMC) and retreatment of a maxillary molar with a previously missed MB2 canal. These cases highlight both the clinical challenges encountered in routine endodontic practice and the handling advantages of this material.

GuttaFlow Bioseal is a silicone-based sealer enriched with calcium silicate and bioactive glass, designed to combine the mechanical adaptability of gutta-percha with the bioactivity of bioceramics. Its ability to release calcium and phosphate ions and stimulate hydroxyapatite crystal formation enables chemical bonding to dentin, thereby enhancing long-term sealing. [8,9] In the present cases, this property likely contributed to the observed clinical resolution and radiographic evidence of healing during follow-up.

The material's thixotropic flow was particularly advantageous in managing complex canal morphologies. In Case 2, the MMC—a canal frequently overlooked in mandibular first molars—was effectively obturated, with the sealer demonstrating excellent adaptation to the narrow canal walls. Similarly, in Case 3, retreatment of a maxillary molar revealed a missed MB2 canal, which was successfully sealed with GuttaFlow Bioseal following thorough disinfection. The ability of GuttaFlow Bioseal to flow into fine anatomical intricacies, while maintaining dimensional stability, underscores its potential for retreatment cases [10].

Another key advantage of GuttaFlow Bioseal is its balanced expansion and minimal solubility once set, in contrast to conventional resin-based sealers which may undergo shrinkage and dissolution over time.[9] Furthermore, its short setting time permits timely placement of definitive restorations, as demonstrated in all three cases.

III. CONCLUSION

The present case series demonstrates that GuttaFlow Bioseal is a reliable bioactive root canal sealer with favorable clinical handling and biological properties. In all treated cases—ranging from primary therapy and retreatment to complex canal configurations—GuttaFlow Bioseal exhibited excellent adaptability to canal walls, including fine anatomical intricacies such as accessory and middle mesial canals.

The material's unique formulation, combining silicone with bioactive glass and gutta-percha, allowed for both effective sealing and stimulation of a biologically conducive environment for healing. Within the limitations of this case series, GuttaFlow Bioseal may be recommended as a versatile obturation material suitable for diverse endodontic scenarios.

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