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EXPLORING BIOMIMMETIC BIOBASE FORMULATIONS: A CASE REPORT

Dental Science

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ABSTRACT

In the dynamic realm of restorative dentistry, a paradigm shift is underway, redefining the very essence of how we approach tooth restoration. No longer confined to traditional mechanical methods, the field is now embracing biomimetic dentistry—an innovative philosophy that prioritizes the preservation of natural tooth structure and the intrinsic vitality of dental pulp. At the forefront of this movement is Biobase, a leader in developing materials that closely emulate the properties of dentin while incorporating advanced adhesive techniques that minimize stress from resin polymerization. By harnessing these cutting-edge materials and strategies, this approach not only restores the functionality of teeth but also mirrors the natural biomechanics of healthy dentition. This article delves into two compelling clinical cases exemplifying the power and promise of biomimetic restorative protocols, showcasing a future where dental care is as much about conservation as it is about restoration.

KEYWORDS

Vital Pulp, Biobase, Caries Detecting Dye, Immediate Dentin Sealing

INTRODUCTION

In the past two decades, restorative dentistry has evolved significantly from traditional mechanical retention methods to advanced adhesion techniques, paving the way for biomimetic dentistry. This innovative approach emphasizes the preservation of intact tooth structure while effectively restoring the functionality and biomechanics of natural teeth. By utilizing preparation and restorative techniques that safeguard both tooth structure and pulp vitality, the field has made remarkable strides. Additionally, new restorative materials are designed to closely mimic the mechanical properties of natural enamel, dentin, and the dentin-enamel junction (DEJ), ensuring that restored teeth are both biomechanically and aesthetically similar to their natural counterparts. Biobase is at the forefront of this movement, focusing on optimizing tooth reconstruction through materials that emulate dentin's properties and advanced adhesive techniques that reduce stress from resin polymerization .

CASE 1

A 26-year-old female patient was reported to the Outpatient Department of Conservative Dentistry and Endodontics in Bhopal with the chief complaint of discomfort in the lower right molar region. On Clinical examination, dislodged restoration over a mandibular right first molar was seen. Upon further evaluation, the tooth was non-tender to percussion, exhibited vitality on electric pulp tester, and her medical history was non contributory. Radiographic evaluation indicated radiolucency involving enamel, dentin and in close proximation to pulp, leading to a diagnosis of Asymptomatic reversible pulpitis. To preserve pulp vitality, Biomimetic restorative protocols were employed.

After ensuring that the patient has been fully informed and provided their voluntary consent, we initiated the treatment. Rubber dam isolation (Coltene) was employed to facilitate better access to the treatment site and to enhance moisture management during the procedure. Local anesthesia was administered using a 2% lignocaine formulation combined with 1:200,000 adrenaline. The temporary restoration was removed, and the carious lesion was indicated using a chromogenic agent called caries-detecting dye (Cerkamed, Red detector) and then rinsed after 10 seconds. Caries excavation commenced at the dentin-enamel junction (DEJ) utilizing a round bur (FG4 Mani), emphasizing the establishment of a meticulous peripheral seal while effectively removing all demarcated outer carious dentin, indicated by red staining, while preserving the underlying pink-stained residual dentin. Excavation was performed with precision, ceasing 5 mm from the occlusal surface and 3 mm from the adjacent marginal ridge.

The treatment area was subsequently subjected to sandblasting utilizing Korox 50 (Sparedent) and rigorously decontaminated with a 2% chlorhexidine solution (ZoDenta Safe Plus). The site was then dried for 10 seconds to facilitate the inactivation of matrix metalloproteinases, thus promoting optimal adhesive bond strength. Immediate dentin sealing (IDS) was executed employing a universal bonding agent (3M ESPE). The bonding agent was meticulously applied to the prepared dentin surface, then air-dried for 5 seconds to enhance its adhesive properties, and subsequently light-cured for 10 seconds to ensure optimal polymerization and bonding effectiveness.

A 0.5 mm layer of flowable composite resin (3M Filtek Z350) was sequentially applied to the prepared site, followed by the incorporation of Angelus Interlig fibers. Subsequently, a 1 mm layer of composite restorative material (3M) was utilized to complete the biobase restoration. To effectively mitigate the formation of an oxygen-inhibition layer, which can adversely affect polymerization processes, the surface of the biobase was meticulously coated with a glycerin-based gel. This choice of coating serves to create a protective barrier that not only prevents atmospheric oxygen from interfering with the curing process but also enhances the overall physicochemical properties of the substrate.

The entire protocol was conducted utilizing a dental operating microscope set to 10x magnification, thereby ensuring accuracy and meticulous control throughout the process. (Figures 1-7)

Fig.1

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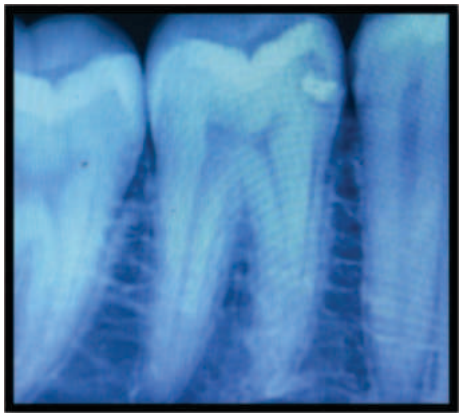

Fig.2

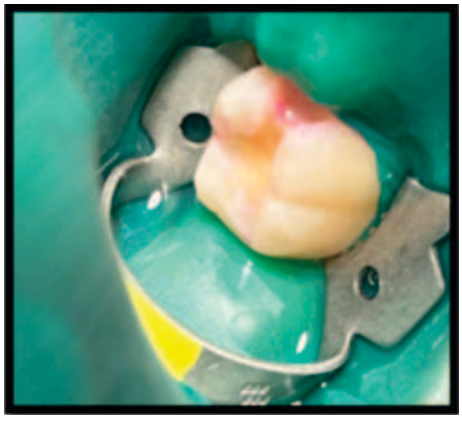

Fig.3

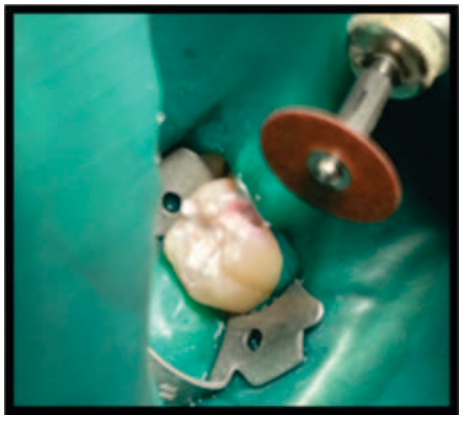

Fig.4

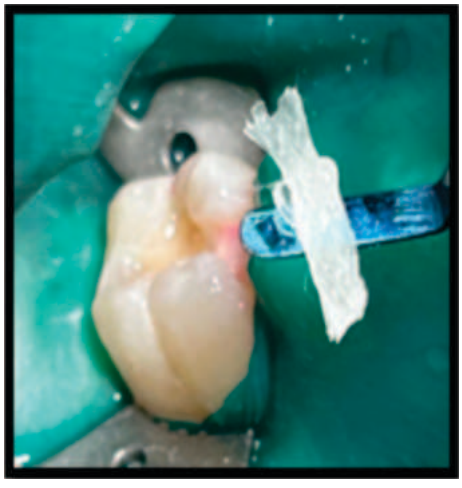

Fig.5

Fig.6

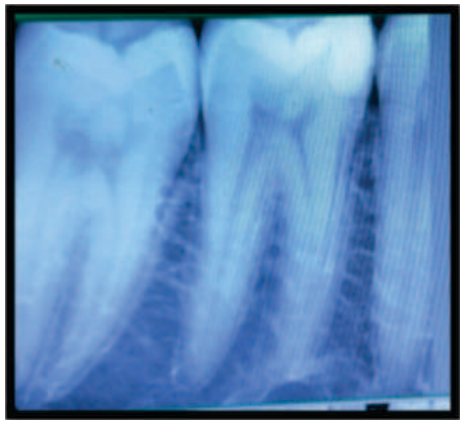

Fig.7

CASE 2

A 31-year-old male presented to the Outpatient Department of Conservative Dentistry and Endodontics in Bhopal with a primary complaint of discoloration and sensitivity in the lower right molar region for the past week. Clinical examination revealed a deep carious lesion. Further assessment showed that the tooth was non-tender to percussion and demonstrated vitality on the electric pulp test, while the patient's medical history was unremarkable. Radiographic analysis revealed radiolucency affecting the enamel and dentin, closely approximating the pulp, leading to a diagnosis of asymptomatic reversible pulpitis. To maintain pulp vitality, biomimetic restorative protocols were utilized.

Following the biomimetic protocols outlined previously, after extensive excavation of the carious lesion, the cavity was subjected to sandblasting and rinsed with chlorhexidine solution. An immediate dentin sealing agent was then applied. Subsequently, 0.5 mm of flowable composite resin was placed, followed by the placement of Angelus Interlig fibers, with an additional 1 mm layer of composite applied on top. After finishing and polishing the restoration, petroleum jelly was applied to enhance the surface finish. This entire procedure was conducted under the magnification of a dental operating microscope. (Figures 8-13)

Fig.8

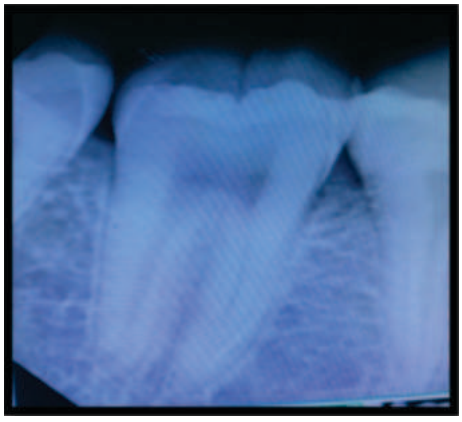

Fig.9

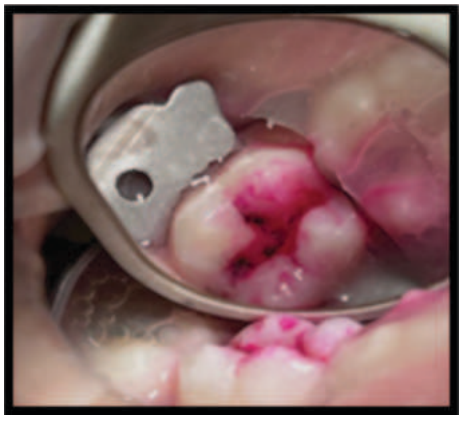

Fig.10

Fig.11

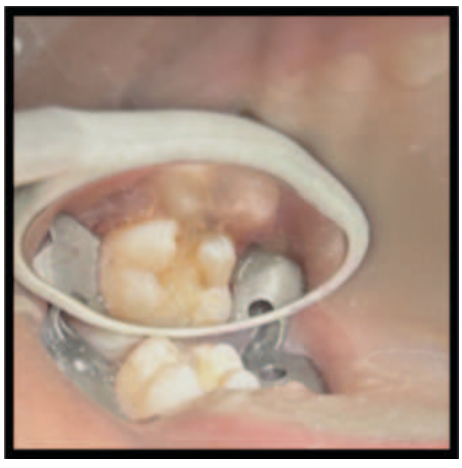

Fig.12

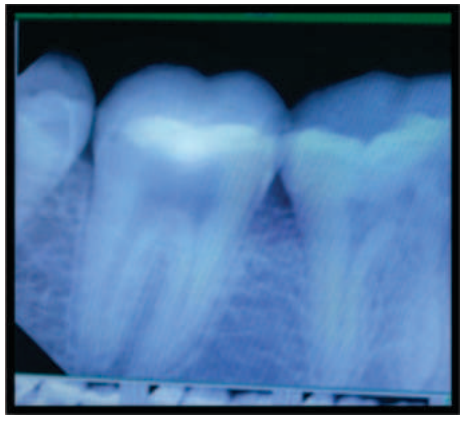

Fig.13

DISCUSSION

The goal of implementing biomimetic restorative techniques and protocols is to prolong the lifespan of dental restorations while reducing or completely avoiding the necessity for subsequent treatments. In addition, maintaining the integrity of tooth structure plays a crucial role in preventing complications related to periodontal health and significantly reduces serious dental issues.

The evolving concept of biomimetic restorative dentistry marks a significant change in dental care, focusing on the preservation of natural tooth structure and the restoration of its original biomechanical functions. By adopting innovative materials and approaches, such as immediate dentin sealing and strategies that minimize stress, dental professionals can craft restorations that authentically reflect the natural dynamics of teeth, significantly boosting their lifespan and performance.

The use of premium materials like 3M ESPE Filtek Z 350 XT highlights the significance of reducing polymerization shrinkage while ensuring maximum bond strength. Furthermore, the use of advanced techniques, such as the integration of interlig fibers, helps to distribute stress and safeguard the integrity of the hybrid layer, thereby contributing to the longevity of restorations.

CONCLUSION

The ultimate aim of biomimetic restorative dentistry is to foster a synergistic relationship between restorative materials and the remaining tooth structure, yielding a robust and lifelike restoration capable of gracefully enduring the demands of daily functionality. This comprehensive approach not only enhances patient results but also underscores the dentist's crucial responsibility in maintaining the health and vitality of the teeth. As research in this area progresses, it becomes evident that biomimetic principles will be pivotal in redefining the future landscape of restorative dentistry, fostering innovations that improve both the aesthetic appeal and functional performance of dental care.

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