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Dental Adhesives—Surface Modifications of Dentin Structure for Stable Bonding  
Bruna Marin Fronza, Roberto Ruggiero Braga, and Milena Cadenaro

The latest advancements in dentin bonding have focused on strategies to impair degradation mechanisms in order to extend the longevity of bonded interfaces. Protease inhibitors can reduce collagen degradation within the hybrid layer (HL). Collagen cross-linkers allow better adhesive infiltration and also inhibit proteases activity. Particles added to adhesive can promote mineral precipitation within the HL, reducing nanoleakage and micro-permeability, besides possible antimicrobial and enzymatic inhibition effects. Most of these approaches are still experimental, and aspects of the adhesive under the clinician’s control are still determinant for the long-term stability of adhesive restorations.

Resin-Based Composites for Direct and Indirect Restorations: Clinical Applications, Recent Advances, and Future Trends  
Despoina Bompolaki, Erinne Bissonnette Lubisich, and Ana Paula Fugolin

Continuous advancements in resin-based composites can make selection of the appropriate system a daunting task for the clinician. This review aims to simplify this process and clarify some new or controversial topics. Various types of composites for direct and indirect applications are discussed, including microfilled and microhybrid composites, nanocomposites, single shade, bulk fill, fiber-reinforced, high temperature/high pressure processed, CAD/CAM, and three-dimensional printable composites. Recent material advancements that lead to improved seal and toughness, degradation resistance, antimicrobial and self-healing capabilities are presented. Future directions are highlighted, such as the development of “smart” materials that are able to interact with the host environment.

Dental Light-Curing—Assessing the Blue-Light Hazard  
Dayane Oliveira and Mateus Garcia Rocha

This article focuses on the current understanding and concerns over the blue-light hazard when using dental light-curing units. It also provides information and safety protocols to guide the practitioner in making important decisions regarding dental personnel’s health and the quality of dental restorations.

Bioactive Restorative Dental Materials—The New Frontier  
Mary Anne S. Melo, Lamia Mokeem, and Jirun Sun

Bioactive materials for dental resin restorations are a rising field of investigation exploring treatment strategies for reducing the recurrence of
carious lesions. The current effort has been directed toward developing dental materials that can inhibit biofilms and prevent tooth mineral loss. Bioactive resin materials have shown the potential to interfere with polymicrobial consortia in vivo and help maintain the lifespan of restorations.

Digital Technologies for Restorative Dentistry
Hidehiko Watanabe, Christopher Fellows, and Hongseok An

Although the accuracy of direct digitization of oral structure has been improved, indirect digitization is still required in specific situations such as full-arch scanning. Once accurate images are imported, efficient designing can be achieved by CAD software. Although smile design using a 3-dimensional facial scan better predicts planned restorations, further improvement in virtual articulators is needed for complex cases. Computer-aided manufacturing can be offered in several formats such as chairside, laboratory, or centralized fabrications. The subtractive technique is mainly used for restorations, and many chairside CAM materials are available now, but the additive technique has the potential to save materials and an advantage in fabricating complex geometries. Limited evidence is available in applying CAD/CAM technologies in implant restorations. However, it is used to fabricate custom implant abutments and crowns from various materials such as titanium, zirconia, and PEEK and hybrid crowns using stock titanium base abutments.

Advances in Ceramics for Dental Applications
Atais Bacchi and Paulo Francisco Cesar

The purpose of this study is to present current dental ceramic materials and processing methods. The clinical indication was emphasized on basis of the material’s microstructure and composition. Studies of ceramic characterization were also discussed, as they impact the clinical indication and serve as a parameter for the development of new materials. The novel strategies were mostly found aiming to mimic the natural dental structures, provide mechanical reliability, and develop predictable restorations in terms of adaptation and design.

Current Protocols for Resin-Bonded Dental Ceramics
Markus B. Blatz, Julian Conejo, Amirah Alammar, and Jose Ayub

Resin-bonded ceramic restorations are common treatment options. Clinical longevity of resin-bonded ceramic restorations depends on the quality and durability of the resin-ceramic bond. The type and composition of the specific ceramic determines the selection of the most effective bonding protocol. Such protocol typically includes a surface pretreatment step followed by application of a priming agent. Understanding of fundamental ceramic properties and chemical compositions enables the clinician to make proper material selection decisions for clinically successful and long-lasting restorations. Based on research accrued over the past decades, this article reviews and discusses current resin-bonding protocols to most commonly used dental ceramics.
Dental Implants: Enhancing Biological Response Through Surface Modifications

In-Sung Luke Yeo

Surface characteristics are an important factor for long-term clinical success of dental implants. Alterations of implant surface characteristics accelerate or improve osseointegration by interacting with the physiology of bone healing. Dental implant surfaces have been traditionally modified at the microlevel. Recently, researchers have actively investigated nano-modifications in dental implants. This review explores implant surface modifications that enhance biological response at the interface between a bone and the implant.

Regenerating the Dental Pulp–Scaffold Materials and Approaches

Diana Gabriela Soares and Vinicius Rosa

Novel technologies and platforms have allowed significant breakthroughs in dental pulp tissue engineering. The development of injectable scaffolds that can be combined with stem cells, growth factors, or other bioactive compounds has enabled the regeneration of functional dental pulps able to secrete dentin in preclinical and clinical studies. Similarly, cell-homing technologies and scaffold-free strategies aim to modulate dental pulp self-regeneration mediated by resident stem cells and can evade some of the technical challenges related to cell-based tissue engineering strategies. This article will discuss emerging technologies and platforms for the clinical applications of dental pulp tissue engineering.

Biomaterials for Periodontal Regeneration

Yuejia Deng, Yongxi Liang, and Xiaohua Liu

As a widespread chronic disease, periodontitis progressively destroys tooth-supporting structures (periodontium) and eventually leads to tooth loss. Therefore, regeneration of damaged/lost periodontal tissues has been a major subject in periodontal research. During periodontal tissue regeneration, biomaterials play pivotal roles in improving the outcome of the periodontal therapy. With the advancement of biomaterial science and engineering in recent years, new biomimetic materials and scaffolding fabrication technologies have been proposed for periodontal tissue regeneration. This article summarizes recent progress in periodontal tissue regeneration from a biomaterial perspective. First, various guide tissue regeneration/guide bone regeneration membranes and grafting biomaterials for periodontal tissue regeneration are overviewed. Next, the recent development of multifunctional scaffolding biomaterials for alveolar bone/periodontal ligament/cementum regeneration is summarized. Finally, clinical care points and perspectives on the use of biomimetic scaffolding materials to reconstruct the hierarchical periodontal tissues are provided.

Assuring the Safety of Dental Materials: The Usefulness and Application of Standards

Spiro J. Megremis

The formal history of standards and dentistry in the United States goes back to World War I and was prompted by the government’s need to
buy large quantities of dental materials to treat “an army of teeth in disrepair.” This article covers the use of scientific research to establish specifications and standards used to evaluate dental materials and products, and how a practitioner can use these standards to assure the safety and performance of the materials that they use in their everyday practice.