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Editorial

Special Issue on Dental Materials: Latest Advances and Prospects

Vittorio Checchi

Department of Surgery, Medicine, Dentistry and Morphological Sciences, University of Modena & Reggio Emilia, 41125 Modena, Italy; vittorio.checchi@unimore.it; Tel.: +39-0594224763

Most fields of dentistry are closely related to newly developed materials, and all clinical improvements often follow or, in any case, go hand in hand with the creation and development of innovative and higher-performing materials, instruments, and equipment. Thanks to contemporary dental material applications, the effectiveness of clinical dentistry has made remarkable advances. In recent years, new materials have been developed and proposed in each field of dentistry: prosthesis, restorative dentistry, endodontics, implantology, and orthodontics. Unfortunately, as often happens, this productive challenge is not always accompanied by valid scientific research, and consequently, the clinician finds at his disposal materials that are not necessarily better than the previous ones.

The aim of this Special Issue was to collect high-quality research articles, clinical studies, review articles, and case reports focused on the latest advances and prospects of dental materials.

A total of 19 papers (17 research papers and 2 review papers) are presented in this successful Special Issue.

Murri Dello Diago et al. [1] evaluated the efficacy of erosion–infiltration treatments with resin in children with a strong hypersensitivity and also developed a minimally invasive diagnostic–therapeutic pathway for young MIH patients. All patients reported lower sensitivity values at the end of the treatment. The authors concluded that the treatment of erosion infiltration with resin is a minimally invasive preventive treatment that significantly improves the problem of hypersensitivity in permanent molars with MIH.

Lehmann et al. [2] aimed to assess how selected restorative materials influence the environmental pH. The initial pH levels were significantly lower for glass ionomer cements compared to composites. With time, the pH increased for samples with glass ionomer cements, whereas it decreased for samples with composites. In the end, all materials were in the pH range between 5.3 and 6.0. The authors concluded that, immediately after application, restorative materials decrease the environmental pH, especially light-cured glass ionomer cements. For glass ionomers, within two weeks, the pH increased to levels comparable with composites.

Chisnoiu et al. [3] compared the effect of two different layering techniques of the dental composite in reducing the marginal microleakage when a brand-new material is used. Some better results were obtained for the oblique layering technique, but the differences from the other method have not been statistically validated.

Liang et al. [4], with an in vitro study, evaluated the changes in surface morphology and flexural strength of translucent monolithic zirconia surfaces treated with femtosecond laser technology. The surface roughness after femtosecond laser treatment was significantly improved compared with the negative control group and the group that received the airborne particle abrasion treatment. In comparison with the airborne particle abrasion group, the flexural strength of the group that received the femtosecond laser treatment was significantly improved. The femtosecond laser approach using appropriate parameters seemed to enhance the roughness of the zirconia without reducing its flexural strength.

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Tobar et al. [5] evaluated the effect of different manufacturing techniques and pontic design on the vertical marginal fit of cobalt–chromium (Co–Cr) posterior fixed partial denture (FPD) frameworks. The vertical marginal discrepancy values of all FPDs were below 50 µm. No differences were found among intermediate pontic groups or cantilevered groups. Likewise, when differences in a marginal discrepancy between both framework designs were analyzed, no differences were observed. The analyzed digital technologies demonstrated a high precision of fit on Co–Cr frameworks and on both pontic designs.

Generali et al. [6] compared conventional endodontic needle irrigation, passive ultrasonic irrigation, apical negative pressure irrigation, and mechanical activation to remove calcium hydroxide from single straight root canals. Eighty-four mandibular premolars were prepared in a crown-down manner up to size #40. Considering the whole canal, all instruments showed better performance than conventional endodontic needle irrigation in removing calcium hydroxide. Passive Ultrasonic Irrigation and Mechanical Activation could remove a significantly higher amount of calcium hydroxide than Apical Negative Pressure Irrigation. Passive Ultrasonic Irrigation and Mechanical Activation have been able to remove more calcium hydroxide than Apical Negative Pressure Irrigation.

Moreinos et al. [7] aimed to evaluate the healing capacity of bony lesions around biofilm-infected and non-infected gutta-percha (GP) points. This study showed that bone healing is possible around both sterile and infected GP points. This contradicts the claim that some root canal treatments fail because of non-microbial factors, including extruded root canal filling materials, which may cause foreign body reactions. The healing observed suggests that overextension should not be considered an indication for endodontic surgery.

In their descriptive review, Solomon et al. [8] presented a synthesis of the types of barrier membranes available and their characteristics, as well as future trends in the development of barrier membranes along with some allergological aspects of membrane use.

De Angelis et al. [9] investigated the material used for titanium meshes. Specific test samples were obtained from two different manufacturers with two different shapes: surfaces without perforations and with calibrated perforations. The authors concluded that a normal masticatory load cannot modify the device and that chemical action in the case of exposure does not create macroscopic and microscopic alterations of the surface.

Kim et al. [10] evaluated the effect of a commercialized octacalcium phosphate (OCP)-based synthetic bone substitute material in vitro, in vivo, and in clinical cases. Compared with a commercial biphasic calcium phosphate ceramic (MBCP+TM), OCP suppressed RANKL and increased ALP activity. An animal model showed that 1.0 mm OCP granules had a higher new bone formation ability than 0.5 mm OCP granules. Moreover, eight implants placed in the three patients showed a 100% success rate after 1 year of functional loading. This basic research and clinical application showed the safety and efficacy of OCP for bone regeneration.

Sanchez-Perez et al. [11] studied how photoactivation with ultraviolet C light can reverse the effects derived from biological aging by restoring a hydrophilic surface. Power proved to be the most important factor, and the best hydrophilicity result was obtained with a power of 85 W for 60 min at a wavelength of 254 nm.

Van der Schoor et al. [12] described 5-year survival results and crestal bone level changes around immediately provisionalized Trabecular Metal Dental Implants. Clinical evaluations with radiographs were conducted at 1 month, 3 months, 6 months, and 1 to 5 years. In total, 30 patients (37 implants) were treated. There was one implant failure; cumulative survival at 5 years was 97.2%. After the initial bone loss of 0.40 mm in the first 6 months, there were no statistically significant changes in the crestal bone level over time up to 5 years of follow-up.

In their systematic review, Bucur et al. [13] reviewed the literature and evaluated the failure rates and factors that affect the stability and success of temporary anchorage devices used as orthodontic anchorage. Although all articles included in this meta-analysis reported success rates of greater than 80%, the factors determining success rates were inconsistent between the studies analyzed, making it difficult to reach conclusions.

Ito et al. [14] examined whether plating of orthodontic wire with titanium nitride could prevent the leaching of metal ions from the wire on immersion in acid. Results indicated that titanium nitride plating of orthodontic wire significantly suppressed the elution of metal ions on immersion in acid.

Bucur et al. [15] analyzed and identified a methodology for the improvement in the shear bond strength of orthodontic brackets bonded with two orthodontic adhesive systems under various enamel conditions (dry, moistened with water, and moistened with saliva). While clinically acceptable shear bond strengths were obtained for all studied groups, in the case of water contamination, it is preferable to use Fuji Ortho LC instead of Transbond Plus.

Farronato et al. [16] compared the effect of fluorescent and conventional non-fluorescent composites on dental surfaces and composite remnants by in vitro de-bonding tests. The use of fluorescent composite could significantly improve the quality of de-bonding by reducing the quantity of composite residuals and visible enamel damage, while reducing the time needed for successful procedure performance.

Memè et al. [17] investigated the effect of different times of demineralization on the chemical composition and the surface morphology of dentinal particles. Extracted teeth were divided into five groups based on demineralization time with 12% EDTA. Fourier-Transform Mid-Infrared spectroscopy analysis showed a progressive reduction in the concentration in the specimens (T0 > T2 > T5 > T10 > T60). A Scanning Electron Microscopy examination showed that increasing the times of demineralization resulted in a smoother surface of the dentin particles and a higher number of dentinal tubules.

Murzakhanov et al. [18] presented the results of a study of radiation-induced defects in various synthetic calcium phosphate powder materials (hydroxyapatite and octacalcium phosphate) by electron paramagnetic resonance spectroscopy at the X, Q, and W-bands (9, 34, and 95 GHz for the microwave frequencies, respectively). It was shown that in addition to the classical electron paramagnetic resonance techniques, other experimental approaches such as ELDOR-detected NMR, electron spin echo envelope modulation, and electron-nuclear double resonance can be used to analyze the electron–nuclear interactions of CP powders.

Finally, Kim et al. [19] stated that when the root of an impacted inferior third molar is impacted in the lingual cortical plate, a periapical band-like radiolucent sign may appear in the orthopantomography image. This could be useful for the prediction of root position and surgical risks.

Although submissions for this Special Issue have been closed, more in-depth research in the field is being collected in a new Special Issue: "Dental Materials: Latest Advances and Prospects–Volume II" (https://www.mdpi.com/journal/applsci/special_issues/Advanced_Dental_Materials_II).

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