

## CLINICAL APPLICATION OF THE CONTEMPORARY NANO-MATERIALS (part 1 – laboratory composites)

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### SUMMARY:

Nano-technology and nano-materials have become an extremely active field of research in the last decade, because of their potential application in different areas like medicine, information technologies, energy storage etc. The unique properties of nano-sized particles, which are subject of quantum mechanics, determine the great interest.

The main purpose of using nano-technologies in dental materials is achieving higher mechanical properties, higher abrasion resistance and less shrinkage of dental composites, improved optical and aesthetic properties of composites and ceramics. Till now the nano-technologies are used in production of wide range of dental materials: light polymerization composites and their bonding systems, imprint materials, ceramics, coatings for dental implants and bioceramics. The aim of this paper is to make an overview of nano-materials, designed for and used in the practice of dental medicine.

**Key words:** laboratory composites, Adoro, Vectris, post-monoblock overlay

### PURPOSE:

The aim of this article is to make an overview of nano-materials, designed for and used in the practice of prosthetic dental medicine. Part 1 will discuss the clinical applications of laboratory composites (LC).

### INTRODUCTION:

Laboratory composites, as well as the clinically applied ones, consist of inorganic fillers (ceramic particles) in organic matrix (polymer), that contains also initiators for light or chemical polymerization, stabilizers and pigments. The matrix and the fillers are combined for the increase of the composite's mechanical properties. The most frequently used bonding agent is organic silan: gamma-methacryloxypropyl-threemethoxysilan. The properties of the laboratory composites depend on their main components. The most frequently used monomer in the matrix is BIS-GMA (bisphenol A glycidilmethacrylat). It has big viscosity at room temperature and for achieving of appropriate thickness for inclusion of the fillers, monomers with lower molecular weight and lower viscosity are added to it. These are usually monomers of ethylenglycol-dimethacrylate (EGDMA) and of three-ethylenglycol-dimethacrylate (TEGDMA). Contemporary laboratory composites find their clinical application in fixed restorations like: crowns, facets, bridges, core built-ups, overlays, post-monoblock overlay.

### METHODS AND MATERIALS:

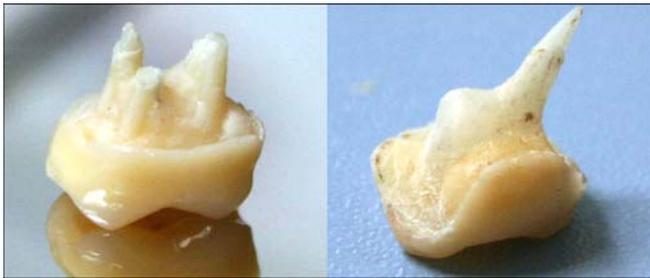
Adoro laboratory composite with Vectris reinforcing fibers. Core built-ups, ( fig. 1, fig. 2) monoblock overlays, post-monoblock overlays, ( fig. 3, fig. 4) crowns, (fig. 5, fig. 6, fig. 7) bridges, (fig. 8, fig. 9) veneers (fig. 10).



Fig. 1. Multi-component core built-ups



**Fig. 2.** Core built-ups



**Fig. 3.** Post-monoblock overlay on molar



**Fig. 5.** Adoro crown of a central incisor



**Fig. 4.** Post-monoblock overlay on premolar



**Fig. 6.** Adoro-Vectris molar crowns



**Fig. 7.** Clinical view of the crowns



**Fig. 9.** Bridges' framework and clinical view



**Fig. 8.** Vectris bridge framework



**Fig. 10.** Adoro veneers and crowns

**RESULTS:**

For a period of 8 years were produced 92 core built-ups, 51 monoblock overlays, 75 post-monoblock overlays, 112 crowns, 56 three-unit bridges, 21 four-unit bridges. On the third year only one pin, of a core built-up on tooth 22, broke. Except from the several small edge breaks in the border area Adoro – tooth enamel and the slight abrasion in the occlusal contact points, the restorations are functionally suitable.

**DISCUSSION:**

Laboratory composites were underestimated for a long time. Their bad reputation is almost due to the weak mechanical properties of the first LC. With the introduction

of nano-technologies and the improvement of the mechanical properties and their polish, LC are no longer “temporary materials”. They are widely used today as long-term temporary restorations and sometimes as permanent ones.

**CONCLUSION:**

The general conclusion is that properties like: high aesthetics, easy technology, mechanical strength, good patients' adaptation to the material, opportunity for clinical repairs, low allergy-causing potential and economic expedience, demonstrated the LC as contemporary nano-materials and proved their position in the dental medicine.

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