



In Memoriam: Nobuo Nakabayashi (1936–2021), “Discoverer” of the Hybrid Layer

Dr. Nobuo Nakabayashi, Professor Emeritus of Tokyo Medical and Dental University (TMDU) passed away on December 28, 2021 at the age of 85.

Dr. Nakabayashi was born in Tokyo on March 3, 1936. He obtained his BS in 1958, MS in 1961 and PhD in 1964 from the Tokyo Institute of Technology (thesis: Preparation of Reactive Polymers). He started his professional career as an Assistant Professor at TMDU in 1964. From 1967–1968, he was a research fellow in the Department of Chemistry, Yale University.

Dr. Nakabayashi was later promoted to the position of Associate Professor in 1969–1981 and then full Professor in 1981 up to 2001, when he retired from TMDU. He was a director at the Institute for Medical and Dental Engineering of TMDU, between 1996 and 1999. Upon his retirement in 2001 from TMDU, he was awarded the title of Professor Emeritus.

Dr. Nakabayashi devoted his energy to the development of dental adhesive materials and his renowned breakthrough of the micromechanical mechanism of dentin bonding. This discovery had a significant impact for clinicians and researchers worldwide and was one of the greatest contributions to the further development and advancement of adhesive dentistry.

Dr. Nakabayashi focused his research on the structure of phospholipids in a membrane model at the dawn of the development of adhesive materials, in which he focused on the synthesis of methacrylates with hydrophilic and hydrophobic groups in one molecule. In the 1970s, a carboxyl monomer, 4-META and a phosphoric acid monomer, phenyl-P, were introduced as adhesion-promoting monomers. These monomers were used in early adhesive materials for orthodontic, prosthodontic, and restorative dental treatments. The concept of the functional monomer established by Dr. Nakabayashi continues to be the focal point for our modern adhesive materials. To this day, the original and analogous adhesive monomers still play an active role in currently used adhesives.



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His other excellent achievement was the elucidation of the adhesive mechanism between dental adhesive materials and dentin. During the 1970s, dentin bond strengths were poor and a method of how to achieve a strong, stable bond to dentin had yet to be determined. In the series of studies on dentin bonding with 4-META/MMA-TBB resin, an ultrastructural examination of the adhesive-dentin interface was performed using SEM and TEM. From these studies of the adhesive-dentin interface, he discovered what he originally termed the “Hybrid Layer” This observation really laid the foundation for advancement of research on adhesive mechanisms between resin-based adhesives and tooth structure. Dr. Nakabayashi received two prestigious awards recognizing his work on dentin adhesion: the Wilmer Souder Award (IADR) in 1994 and the Hollenback Memorial Prize (Academy of Operative Dentistry) in 1997. Dr. Nakabayashi and Dr. David H. Pashley published an excellent book entitled “Hybridization of Dental Hard Tissues” (Quintessence Publishing Co, Ltd, Tokyo) in 1998.

Dr. Nakabayashi is regarded as one of the pioneers in the development of excellent biomaterials which have been applied not only in dentistry, but also in various medical devices, such as artificial blood vessels, artificial hearts, and artificial dialysis.

The importance of Dr. Nakabayashi’s contribution to the minimal intervention concepts of dental treatments we now use in clinical practice, as well as to the widespread use of metal-free restorations in Adhesive Dentistry, cannot be overestimated.

May his soul rest in peace, Dr Nobuo Nakabayashi, “discoverer” of the HYBRID LAYER.

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