

*An interview with*

# Mario Tanomaru Filho

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- » Assistant Professor at UNESP, School of Dentistry of Araraquara, Discipline of Endodontics since 1992
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#### Interviewer

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## **I would like to start this interview by asking to tell us about your general educational background and also about Endodontics.**

I was born in Lins, SP. I am the son of Mario Tanomaru (in memoriam) and Hissae Tanomaru. I studied at a public school up to high school level, and then at the Objective College. I graduated at the School of Dentistry of Bauru - USP (1984 – 1987). Soon after graduation, I was approved for Endodontic Residency at the Hospital for Rehabilitation of Craniofacial Anomalies (HRAC / Centrinho), USP / Bauru. In 1989, I started the Master's program in the area of Endodontics at Bauru School of Dentistry - USP. In 1990, after a public exam, I was approved as professor of Endodontics at the School of Dentistry of Maringá State University. In 1992, after obtaining my Master's degree, I was approved as Professor of Endodontics at the Araraquara School of Dentistry, UNESP. From 1993 until 1996, I completed the PhD program in Endodontics, at the School of Dentistry of Araraquara, UNESP. In 2001, I obtained the title of Associate Professor of Endodontics at UNESP, Araraquara. In 2010, I took the exam for Full Professor of Endodontics at UNESP, Araraquara.

Throughout my training in the area of Endodontics, I had the opportunity to learn and be guided by many professors. I would like to express my gratitude to Professors Clóvis Monteiro Bramante, Alceu Berbert (in memoriam) and Ivaldo Gomes de Moraes (in memoriam), of Bauru, and to professors Mario Roberto Leonardo and Lea Assed Bezerra da Silva, during my professional development studies in Araraquara.

## **In which of the areas of research do you mostly work?**

Although my first studies in Bauru were related to the properties of root canal filling and root-end filling materials, but since I started work in Araraquara, my most extensive research has been conducted in the biological area, as I had the opportunity to conduct research using animal models. Thanks to the professors Mario Roberto Leonardo and Lea Assed Bezerra da Silva for teaching me how to work with usage tests (third level of research evaluation) using dogs as models. These studies, including models of microbiological evaluation under the guidance of Professor Izabel Yoko Ito (in memoriam), enabled me to develop biological and microbiological concepts essential to successful

endodontic treatments. Currently, I lead the research group on Physicochemical and biological properties in Endodontics of UNESP Araraquara ([dgp.cnpq.br/dgp/espelhogrupo/1451104486506470](http://dgp.cnpq.br/dgp/espelhogrupo/1451104486506470)). The main lines of research are:

- » Biological, microbiological and radiographic evaluation in endodontics;
- » Biomaterials;
- » Physicochemical and mechanical properties of materials and endodontic techniques.

These research lines represent many possibilities of projects related to the biological mechanisms of repair and biocompatibility of materials, as well as microbiological evaluations related to materials and endodontic treatment. The physicochemical properties of materials and new root canal preparation, cleaning and obturation techniques are also studied.

## **This line of research on biological concepts applied to endodontic treatment has always been prominent in Endodontics at Araraquara. How do you consider the line today?**

Since the 70's, Prof. Mario Roberto Leonardo and his team have developed biological studies that emphasize the performance of calcium hydroxide as intracanal medication, as well as the importance of biological and microbiological concepts associated with endodontic treatment. His studies in dogs contributed to the worldwide recognition of the importance of biocompatibility of materials and concepts related to periapical tissue repair and disinfection in the success of endodontic treatment.<sup>1,2,3</sup>

In the development of this line of research, the research model using dogs was of essential importance. Studies related to the use of irrigation solutions, intracanal medication and endodontic sealers in the endodontic treatment of dog's teeth with induced periapical lesions were important<sup>1,4,5,6,7</sup> for developing the philosophy of treatment and clinical protocols for endodontic treatment of teeth with pulp necrosis. Since the 2000s, for ethical and academic reasons, it has become more difficult to perform studies with dogs.

With the difficulties of using dogs as research models, we started to develop cell culture studies. Thus, in 2010, with the support of FAPESP and researchers with more experience in this line of research in our Graduate Program (Professors Joni Cirelli, Carlos Rossa and

Gisele Faria), a cell culture laboratory was developed in our Department. The thesis defended by Prof. Loise Pedrosa Salles under our supervision, “The Bioactive Potential of New Endodontic Cements in Osteoblast Cell Line: In Vitro Study”, represented the beginning of cell culture studies. Since then, this laboratory has contributed large number of studies to the evaluation and development of calcium silicate repair materials and endodontic cements.<sup>8,9,10,11</sup>

We also highlight the biological studies performed in rats, with the support of Prof. Paulo Sérgio Cerri. Thus, studies were developed on bone cavities, subcutaneous tissue, and the model of furcation perforation in rat molars. These studies are of great importance for evaluating the biological properties of commercial and experimental materials, thereby contributing to the development of calcium silicate repair materials and endodontic cements based on calcium silicates and bioceramics.<sup>12,13,14,15,16,17</sup>

Since the studies in dogs, in which microbiological evaluations were performed, the studies with applied microbiology in our lines of research deserve to be highlighted. Thus, in 2006, with the support of FAPESP, an Applied Microbiology laboratory was established in our Department under the responsibility of Prof. Juliane Maria Guerreiro Tanomaru. Since then, this laboratory has contributed a large number of studies to the evaluation of antimicrobial properties of irrigating solutions, repair materials and endodontic cements.<sup>18,19</sup> We also highlight the development of studies using microbial biofilms, especially *Enterococcus faecalis*, which are of great importance in evaluating the antimicrobial potential of substances and materials used in endodontic disinfection, with emphasis on the resistant microbiota.<sup>20,21</sup>

### **What were your most important contributions?**

We made our first contributions with the use of the study model in dogs with periapical lesions. Thus, the importance of the biological properties of endodontic sealers in the repair of teeth with periapical lesion was demonstrated<sup>5</sup>. Another study that I consider important highlighted the use of calcium hydroxide-

based medication for the repair of periapical lesions after endodontic treatment, even when bactericidal irrigating solutions were used during the root canal preparation.<sup>4</sup> Also using a study model in dogs, the publication that demonstrated the importance in vivo of calcium hydroxide for inactivating the effects of endotoxin (bacterial LPS), from the dissertation of Prof. Juliane Maria Guerreiro Tanomaru (Effect of different irrigation solutions and calcium hydroxide on bacterial LPS Tanomaru JM, Leonardo MR, Tanomaru Filho M, Bonetti Filho I, Silva LA *Int Endod J.* 2003 Nov; 36 (11): 733-9)<sup>6</sup> represents one of the papers from our research group, with the highest number of citations.

Since the 2000s, our researches with Mineral Trioxide Aggregate (MTA) and later with Portland cement and calcium silicate cements contributed to the development of new materials. In collaboration with Prof. Marco Antonio Hungaro Duarte, we investigated new radiopacifiers for calcium silicate cements,<sup>22,23</sup> and many of these options were used by the industry in the development of current biomaterials. These publications about calcium silicate cements provided us with the opportunity to participate - by writing a chapter - in the book *Mineral Trioxide Aggregate in Dentistry. From Preparation to Application*, by Camilleri, J, published in 2014.<sup>24</sup> Publications with experimental materials using Portland cement<sup>25,26</sup> and more recently calcium trisilicate<sup>27</sup> or associations of silicates in the formulation of bioceramic sealers<sup>28</sup> represent contributions to the development of repair biomaterials and endodontic sealers.

In the line of applied microbiology, under the guidance of Prof. Juliane Maria Guerreiro Tanomaru, we conducted research to define biofilm models of *Enterococcus faecalis*<sup>6</sup> and experimental models for evaluation of endodontic procedures in infected root canals.<sup>2,21,29</sup>

Since 2015, we have performed studies using computed microtomography in the evaluation of endodontic techniques and analysis of properties of repair cements and endodontic sealers.<sup>30,31,32,33,34</sup> Among these studies, we highlight some models of for evaluating physicochemical properties such as flow and dimensional change of repair materials and endodontic sealers using computed microtomography.<sup>31,33</sup>

## What are your future expectations and what are the major challenges for studies that can effectively contribute to the success and evolution of Endodontics?

The first challenge is the search for partnerships that can enhance knowledge and research possibilities with new methodologies, considering the evolution of applied science in dental research, and the search for excellence in scientific production with a high impact on the endodontic clinic. In addition to partnerships with national research centers such as USP-Bauru and USP-São Carlos, we will look for international collaborations with researchers in centers of excellence in the development of biomaterials and in methodologies involving Micro-CT.

Regarding the greatest challenges in the elaboration of studies that can effectively contribute to the success and evolution of Endodontics, we must consider that Endodontic technology has undergone great evolution in the last decades, which has not always been accompanied by higher success rates. Thus, the greatest challenge for endodontic research is the search for clinical solutions that can associate the technology and simplification of endodontic treatment with increased success and repair after treatment. The technical objectives of root canal preparation are achieved more quickly and simply with the development and treatment of nickel-titanium alloys. However, root canal cleaning may be less effective.<sup>35</sup> Auxiliary procedures such as instruments for final cleaning and inserts for ultrasonic irrigation represent advances in the complementation of endodontic cleaning and disinfection. However, they are not effective to achieve complete root canal system disinfection. This is the challenge in Endodontics, how to clean and promote disinfection in the root canal system. In this context, scientific evidence has demonstrated that procedures complementary to biomechanical preparation for disinfection of the root canal system, such as the use of calcium hydroxide-based medication, are of great importance and have impact on the successful treatment and repair of teeth with

periapical lesions.<sup>3,4,36</sup> Thus, studies that allow rapid treatment (in a single session) of teeth with necrosis and periapical lesions represent an important challenge to endodontics.

It is also necessary to know more about the interrelationship between maintenance of endodontic infection and repercussions on systemic health, according to Prof. Luciano Cintra, in the previous interview in this journal.

With respect to biomaterials in Endodontics, we observed a great evolution in the last decade with the development of reparative bioceramics and endodontic sealers.<sup>37</sup> Endodontic science can also contribute to the improvement of some physicochemical and antimicrobial properties, contributing to the success of endodontic obturation and tissue repair after endodontic treatment.

I am very grateful to the professors, researchers and supervisors with whom I had the opportunity to live and work with during this academic life, many of them are mentioned in this text. I also extend my thanks to the numerous undergraduate and graduate students with whom I had the opportunity to teach and learn. The Graduate students I preferred not to mention, because they are many. But I am grateful for the experiences and partnerships that allowed the development of a huge number of the researches cited here and the other projects that we are developing together. These partnerships with students of Scientific Initiation, Master's, Doctorate and Post-Doctorate studies represent my motivation in the search of new knowledge, projects, grants and opportunities. I would also like to thank the professors of Endodontics of the Dental School of Araraquara Idomeo Bonetti Filho, Renato Leonardo, Fabio Berbert and Juliane Maria Guerreiro Tanomaru, for our experiences gained during this journey. I thank God for enabling my work to contribute to the training of professionals and the development of science in dentistry, in order to promote health. Finally, thank you for remembering my name for this interview.

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