



INFLUENCE OF A PHOTOSENSITIZER LOADING ON THE PHYSICOCHEMICAL AND ANTIMICROBIAL PROPERTIES OF A DENTURE RESIN FOR ADDITIVE MANUFACTURING

Amr K. Farrag, Ricardo M. Carvalho, Walaa M. Ahmed, Maria L. Leite, Adriana P. Manso

Department of Oral Health Science, Faculty of Dentistry, The University of British Columbia, Vancouver, Canada



Introduction

Denture stomatitis is a common condition among denture users and various methods have been used to control it. Antimicrobial Photodynamic Therapy (aPDT) is a well-researched strategy that involves using a specific wavelength of light to activate a photosensitizer, leading to the formation of reactive oxygen species (ROS) with strong antimicrobial properties. Riboflavin (vitamin B2) has been used in PDT due to its ability to produce ROS when exposed to blue light. Thus, the use of B2 could assist in the control of *C. albicans* if loaded in denture base materials and combined with blue light treatment.

Objectives

To examine the influence of riboflavin (B2), a natural photosensitizer, on physicochemical and antimicrobial properties of a denture base resin used in additive manufacturing.

Materials and Methods

Three experimental formulations (0%B2, 1%B2, and 2%B2) were prepared by loading different concentrations of B2 into a 3D-printing denture resin (Lucitone Digital Print-3D Denture Base, Dentsply Sirona, Charlotte, USA). Then, 3D-printed resin discs (1mmx6mm) were fabricated and subsequently coated with the experimental resins (Fig 1.). Antimicrobial properties were assessed on *C. albicans* biofilms under dark and blue light conditions (81 J/cm²) by colony-forming unit (CFU) test (n=9). Scanning electron microscopy (SEM) was performed to examine the biofilms. Additionally, contact angle (n=6), surface roughness (n=6), and degree of conversion were evaluated (n=6).



Fig. 1: 3D printed discs coated with 0%B2, 1%B2, 2%B2 (From left to right)

B2-containing groups treated with light showed reduction in CFU counts for *C. albicans* (Fig. 2), and SEM images confirmed these findings with fewer viable *C. albicans* for the 2%B2 associated with light (Fig. 3). Contact angle measurements were 57.2° for 0%B2, 57.5° for 1%B2, and 62.2° for 2%B2 with no significant differences detected (Fig. 4). Similarly, B2 loading into the denture base resin did not compromise the degree of conversion with no statistically significant differences detected (Fig. 5). The average roughness values for resin-coated discs were 310.1 nm for 0%B2, 309.6 nm for 1%B2, and 293.5 nm for 2%B2, with no statistical difference detected (Figs. 6 & 7).

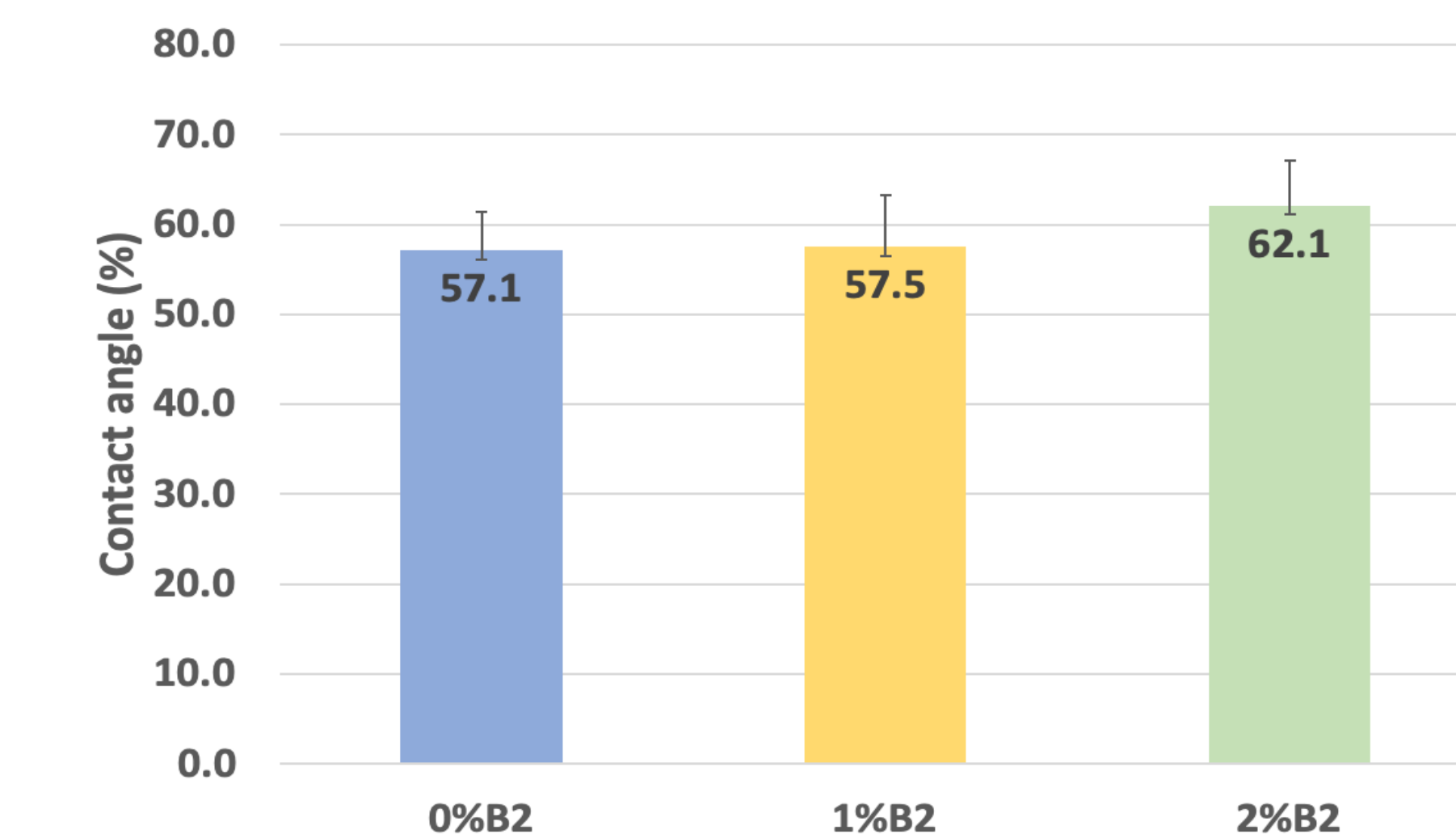


Fig. 4: Contact Angle Results

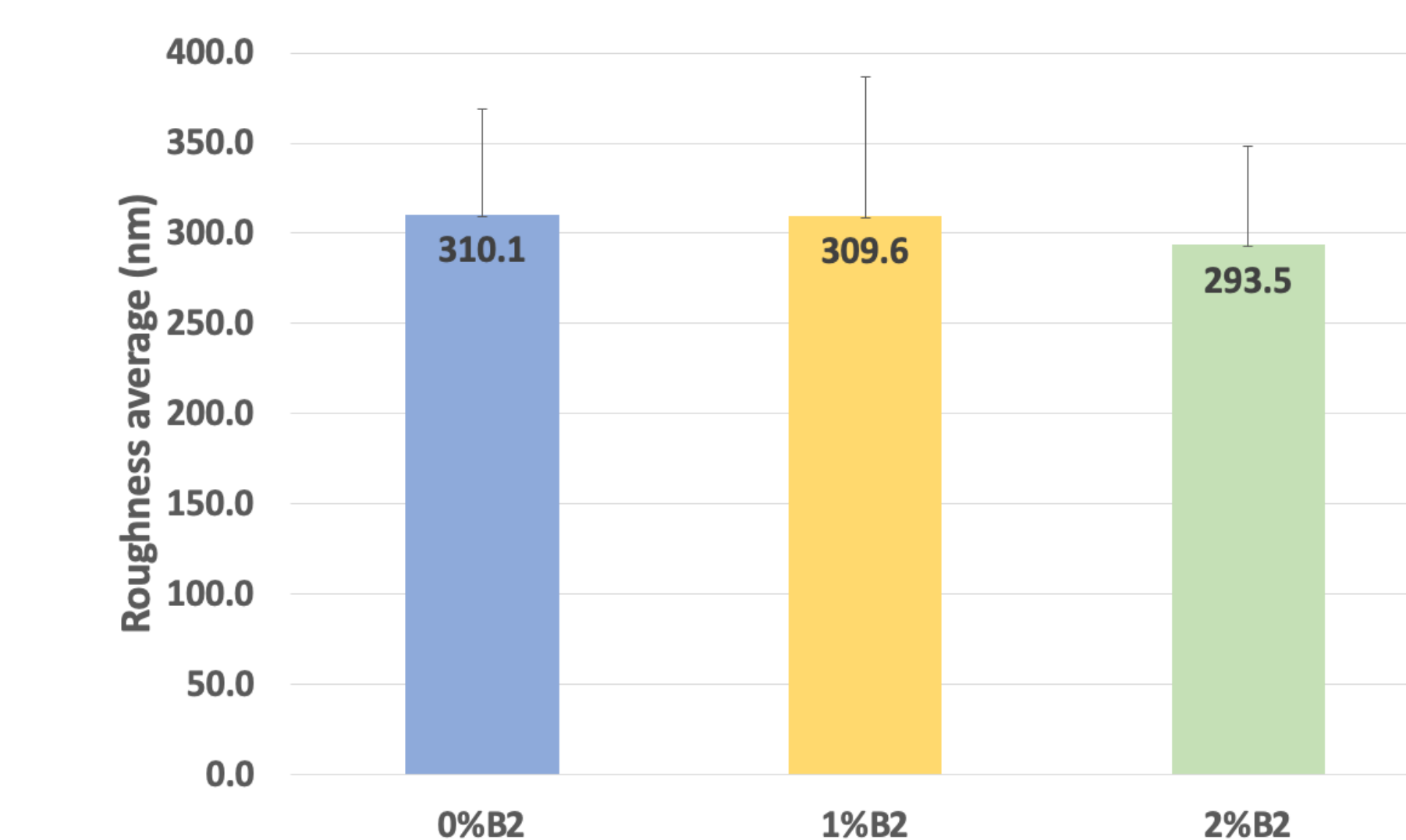


Fig. 6: Roughness Results

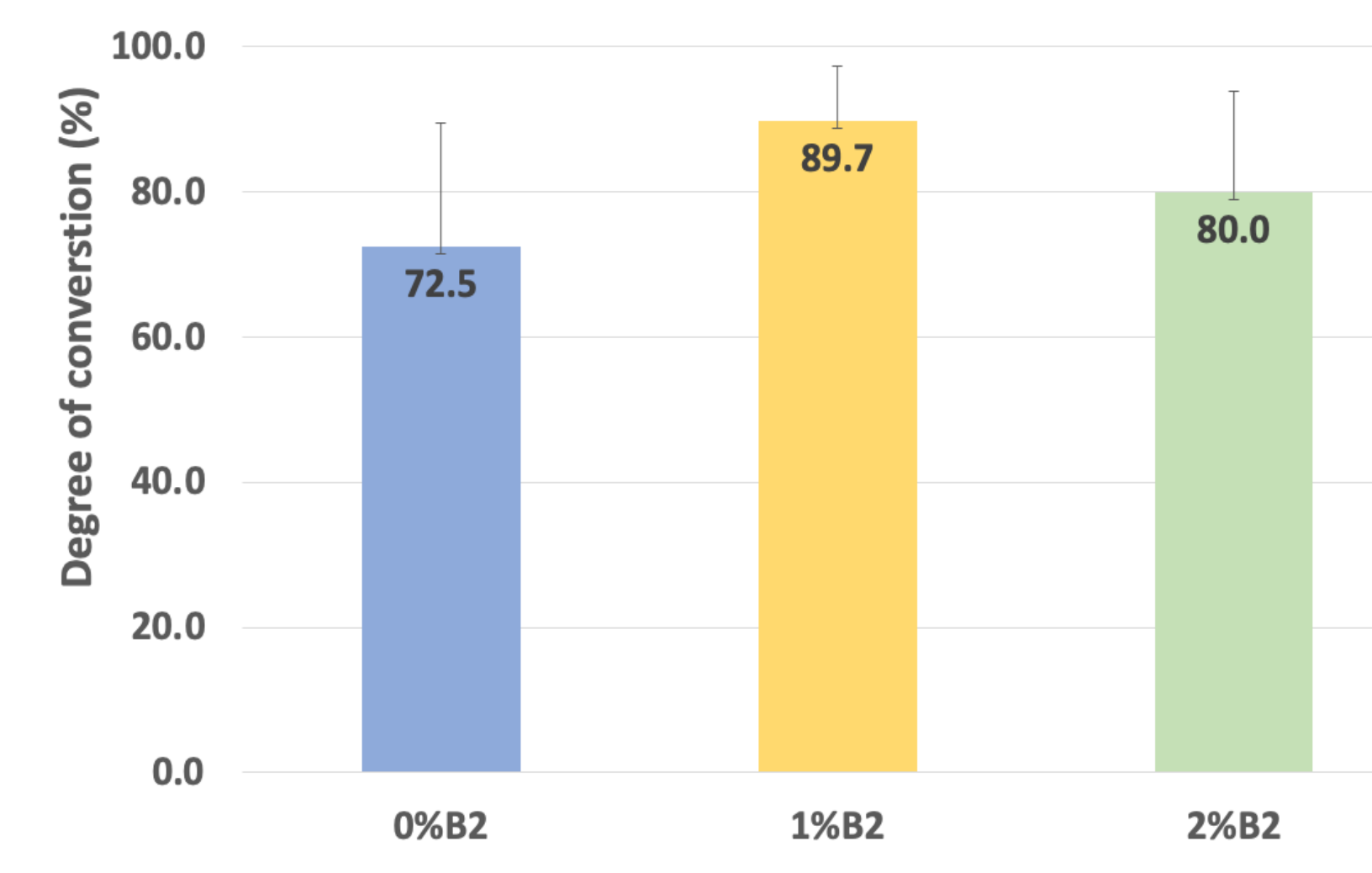


Fig. 5: Degree of Conversion Results

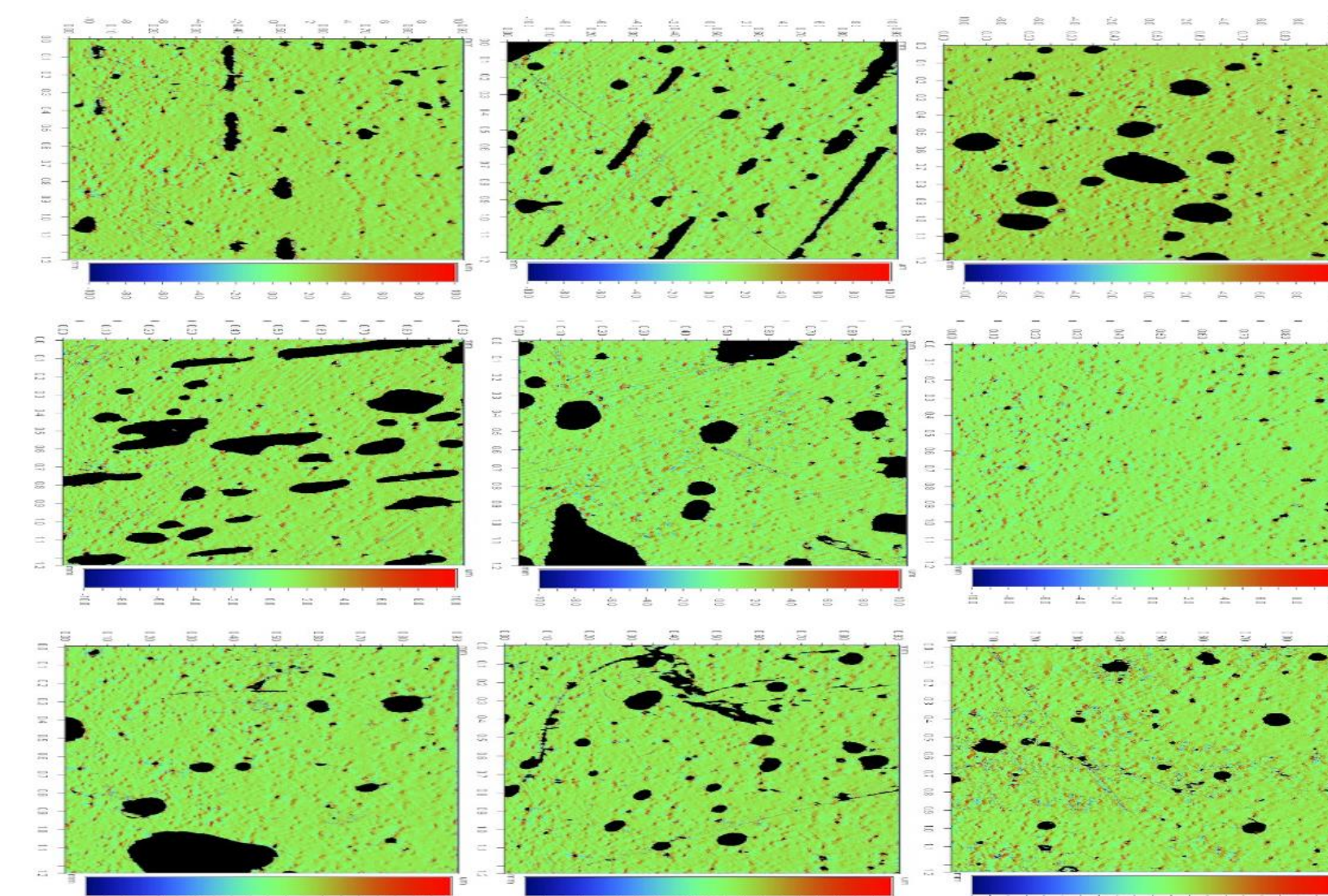


Fig. 7: Non-Contact Profilometer 3D Images

Results

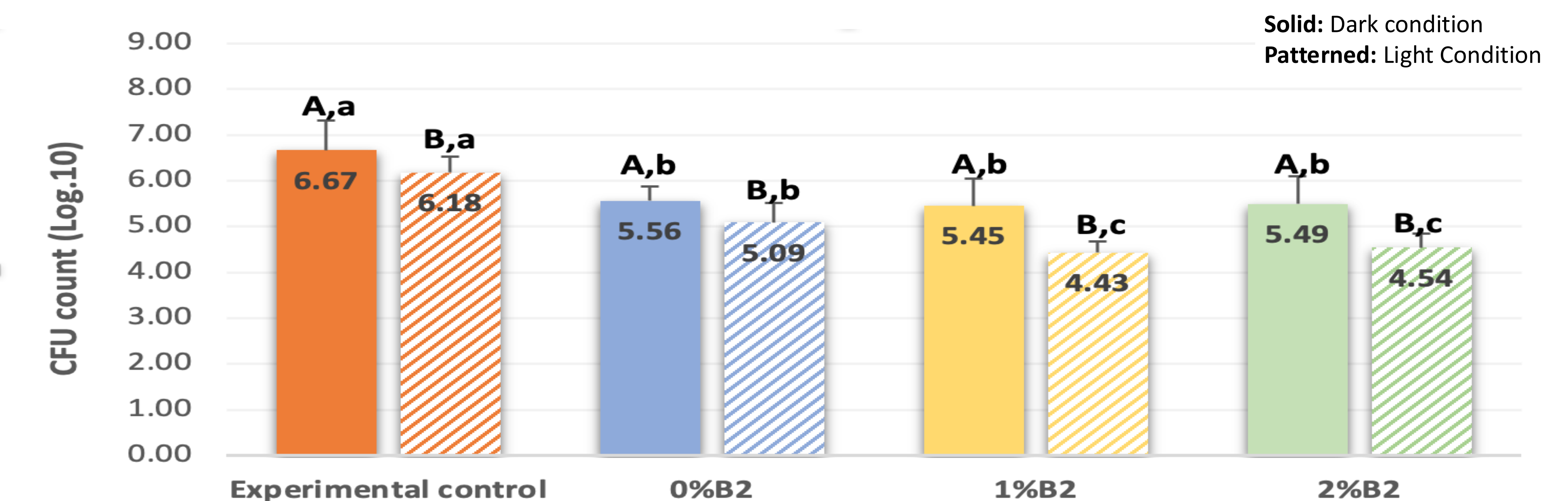


Fig. 2: Colony Forming Unit (CFU) results. Capital letter compare dark vs. light treatment on each experimental group. Lower case letters compared experimental groups on each light condition

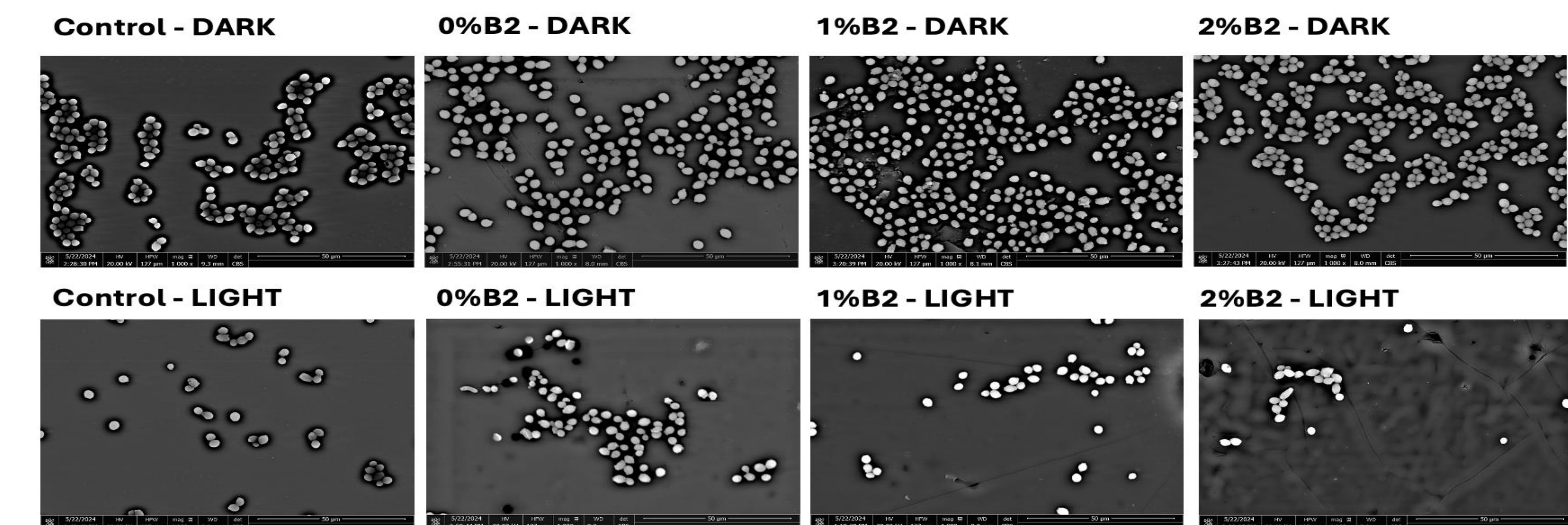


Fig. 3: Scanning Electron Microscope, 1000X magnification

Conclusion

This study highlights the promising role of riboflavin associated with blue light towards an antimicrobial photodynamic therapy associated to a denture resin for additive manufacturing without compromises in its physicochemical properties. These findings underscore the potential for further exploration of riboflavin-loaded dental materials, potentially leading to improved treatment options for dental prosthetics.

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