

INFLUENCE OF COLD ATMOSPHERIC PLASMA TREATMENT ON THE *IN VITRO* PROPERTIES OF 3D-PRINTED BONE SCAFFOLDS

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ABSTRACT

Photocurable resins suitable for stereolithography (SLA) are increasingly used in biomedical engineering for their ability to produce high-precision, patient-specific scaffolds [1]. Among them, BioMed Clear resin (Formlabs), certified for long-term skin and mucosal contact, has emerged as a promising material for applications in tissue regeneration [2]. However, its mechanical performance and surface properties under physiological conditions, as well as the effect of post-processing treatments, remain underexplored—particularly in the context of porous bone scaffolds and their functional reliability over time.

In this study, porous scaffolds for bone regeneration were fabricated using SLA with BioMed Clear resin. The effects of immersion in phosphate-buffered saline (PBS) for periods ranging from 1 day to 6 months were investigated to simulate *in vivo* degradation. Additionally, cold atmospheric plasma treatment (Plasmaction Med, Medical Plasmas) was applied to assess its impact on surface properties and mechanical behavior. Surface energy was evaluated via contact angle measurements to analyze wettability, while mechanical performance was assessed through uniaxial compression and fatigue tests under cyclic loading conditions.

The results show that atmospheric plasma treatment significantly improved the surface wettability by increasing surface energy, which may enhance cell adhesion and proliferation [3]. However, this treatment did not lead to measurable changes in the mechanical properties of the scaffolds or in their aging behavior. Regarding PBS immersion, a slight decrease in mechanical strength was observed after the first day, but the properties remained stable from that point up to six months.

These findings highlight the mechanical robustness of BioMed Clear scaffolds over time, even under physiological conditions, and the potential of plasma treatment to modulate surface characteristics without compromising structural integrity. This work represents an important step toward the clinical translation of SLA-fabricated scaffolds for long-term orthopedic applications.

REFERENCES

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