Effects of grounded electrode on the APPJ treatment for improving water permeability of a bone-regeneration scaffold

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An atmospheric pressure plasma jet (APPJ) employing dielectric barrier discharge of helium gas is known to be a source of “plasma bullets”, which propagate in high-purity helium gas channels. A plasma bullet propagates to the direction independent of gas-flow direction, and nicely separated when they encounter branches of gas channels. These unique features of “plasma bullets” may be used for the treatment of internal surfaces of an interconnected porous scaffold used in bone regeneration. We irradiated helium APPJ to glass filters (thickness 3.15 mm) as a substitute of a practical bone-regeneration scaffold. We examined several glass filters with pore channel diameters of 40-100, 100-160,and 160-250 um. The scaffold was hydrophobic treated using fluorinated compounds before APPJ irradiation. Plasma bullets were injected from one side of the scaffold. The bullets penetrate the scaffold and ejected from the other side of it, which was confirmed through observation with a gated ICCD camera. We have observed excellent water permeability of the scaffold (160-250 um pores) after the APPJ treatment for 1 min. Poor water permeability in the case of smaller pore sizes of 40-100 and 100-160 um was dramatically improved by using grounded electrode behind the sample.

This work was partly supported by JSPS/MEXTKAKENHI Grant Numbers 15H03585 and 15K13391.