Compressibility effects were numerically investigated for use of plasma-based flow control, which was applied to delay transition generated by excrescence on the leading edge of a wing. The wing airfoil section incorporates a geometry that is representative of modern reconnaissance air vehicles, and has an appreciable region of laminar flow at design conditions. Modification of the leading edge can be caused by the accumulation of debris, insect impacts, microscopic ice crystal formation, damage, or structural fatigue, resulting in premature transition and an increase in drag. A dielectric barrier discharge (DBD) plasma actuator, located downstream of the excrescence, was employed to delay transition, mitigate the effects of turbulence, decrease drag, and increase energy efficiency. Solutions were obtained for several Mach numbers, up to the transonic range. The effect of compressibility on transitional behaviour was explored, and the effectiveness of plasma-based control to delay transition with increasing Mach number was determined.