

Reduction of the Cellular Infectivity of SARS-CoV-2 by a Mucoadhesive Nasal Spray

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Abstract : New emerging evidence suggests that the nose is the predominant route for entry of the SARS-CoV-2 virus into the host. A virucidal suspension test (conforming in principle to the European Standard EN14476) was conducted to determine whether a commercial liquid gel intranasal spray containing 1% of the mucoadhesive hydroxypropyl methylcellulose (HPMC) could inhibit the cellular infectivity of the SARS-CoV-2 coronavirus. Virus was added to the test product samples and to controls in a 1:8 ratio and mixed with one part bovine serum albumin as an interfering substance. The test samples were pre-equilibrated to $34 \pm 2^\circ\text{C}$ (representing the temperature of the nasopharynx) with the temperature maintained at $34 \pm 2^\circ\text{C}$ for virus contact times of 1, 5 and 10 minutes. Neutralized aliquots were inoculated onto host cells (Vero E6 cells, ATCC CRL-1586). The host cells were then incubated at $36 \pm 2^\circ\text{C}$ for a period of 7 days. The residual infectious virus in both test and controls was detected by viral-induced cytopathic effect. The 50% tissue culture infective dose per mL (TCID₅₀/mL) was determined using the Spearman-Kärber method with results reported as the reduction of the virus titer due to treatment with test product, expressed as log₁₀. The controls confirmed the validity of the results with no cytotoxicity or viral interference observed in the neutralized test product samples. The HPMC formulation reduced SARS-CoV-2 titer, expressed as log₁₀TCID₅₀, by 2.30 (± 0.17), 2.60 (± 0.19), and 3.88 (± 0.19) with the respective contact times of 1, 5 and 10 minutes. The results demonstrate that this 1% HPMC gel formulation can reduce the cellular infectivity of the SARS-CoV-2 virus with an increasing viral inhibition observed with increasing exposure time. This 1% HPMC gel is well tolerated and can reside, when delivered via nasal spray, for up to one hour in the nasal cavity. We conclude that this intranasal gel spray with 1% HPMC repeat-dosed every few hours may offer an effective preventive or early intervention solution to limit the transmission and impact of the SARS-CoV-2 coronavirus.

Keywords : hydroxypropyl methylcellulose, mucoadhesive nasal spray, respiratory viruses, SARS-CoV-2

Conference Title : ICVVI 2020 : International Conference on Viruses and Viral Infections

Conference Location : Rome, Italy

Conference Dates : September 17-18, 2020