Use of A Sectional Adult Nasal Airway Model for the Evaluation of Nasal Delivery Devices and Administration Techniques

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The nasal cavity is a target for both locally and systemically acting medications. However, it is difficult to evaluate drug deposition in the nasal passageways, and in particular the olfactory region where there is the potential to bypass the blood-brain barrier, with different nasal devices and administration techniques. Two variants of a sectional nasal airway model were developed based on an adult MRI nasal scan (Guilmette and Gagliano, 1994) to visualize deposition patterns and measure regional dosages from a nasal nebulizer (NasoNeb*, Nasoneb Inc., Plattsburgh, NY). Using a longitudinally segmented transparent version of the model a colour-presenting water-finding product (Sar-Gel*, Sartomer Americas, Exton, PA) was used to qualitatively assess deposition. The second model was segmented horizontally (anterior, middle and posterior sections) and made from sintered nylon to allow for chemical compatibility and drug assay. Laser diffraction was used to characterize volume mean diameters (VMDs), n=3 replicates at 6-cm working distance) at Dv10 (21.0±1.1µm), Dv50 (56.1±4.0µm) and Dv90 (231.5±32.9µm) respectively. The mass of budesonide was determined by HPLC-spectrophotometry. Using Pulmicort* Nebuamp* (500µg/2ml, AstraZeneca, Canada Inc.) as test formulation, budesonide recoveries (mean ± SD) from the anterior, middle and posterior portion of the model were 81±16, 173±58 and 39±29 µg respectively.

These analytical results helped confirm the visual observations with the transparent model that showed the bulk of the deposition occurred in the middle/turbinate region of the nose model.