

Non-Oral Applications of gamma scintigraphy

Gamma scintigraphy can be used to investigate the *residence kinetics* of *ophthalmic, nasal and oesophageal formulations* and to study the *deposition of pulmonary formulations*.

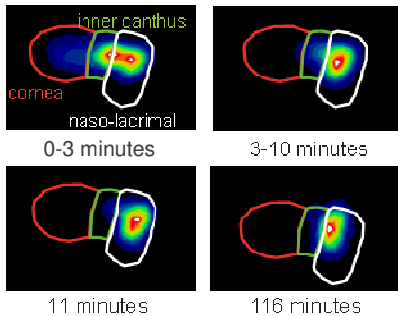
Ophthalmic Delivery



Radiolabelled drops, emulsions or solid preparations applied to the cornea allows quantification of residence and clearance.

Clearance can be strongly influenced by the nature of the formulation, including rheology, bioadhesion and other physicochemical factors. Regions of interest (ROI) can be drawn around the cornea, inner canthus and naso-lacrimal duct and the kinetics of clearance can be determined.

In the first image (0-3 minutes), clearance from the cornea is already progressing via the inner canthus and into the naso-lacrimal duct. The process continues and is complete by 11 minutes.



Nasal Delivery

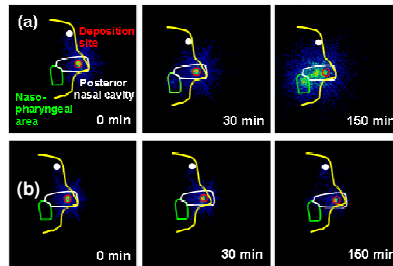
Gamma scintigraphy can be applied to liquid, powder or lyophilised preparations.

In a nasal scintigraphic study, the residence time in the nose and the kinetics of elimination can be correlated with formulation factors.



References

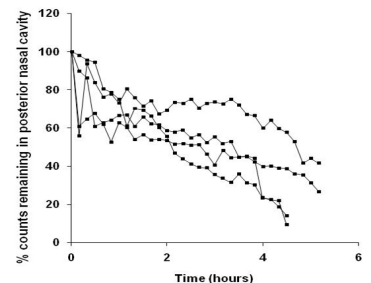
- Lindsay, B., Jones, T., O'Mahony, B., Browne, B., Osborne, S., Wilson, C.G., Boldrini, E. (2002) A scintigraphic investigation of the precorneal residence time of TS polysaccharide formulations in mild to moderate KCS patients. *J. Pharm. Pharmacol.* 54 (Suppl.), S37
- McInnes, F.J., O'Mahony, B., Lindsay, B., Band, J., Wilson, C.G., Hodges, L.A., Stevens, H.N.E. (2007) Nasal residence of insulin containing lyophilised nasal insert formulations, using gamma scintigraphy. *Eur. J. Pharm. Sci.* 31, 25-31
- Boyer, A.C., Fuld, J.P., Jones, T., Wilson, C.G., Stevenson, R.D. (2004) Lung deposition and absorption of nebulised gentamicin in patients with bronchiectasis. *Eur. Respir. J.* 24, Suppl. 48, 707s



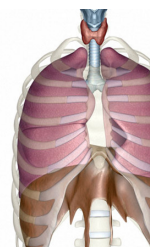
Residence and clearance can be correlated with drug absorption profiles providing useful information to correlate formulation dispersion correlates to plasma drug concentration.

It is possible to visualise the gradual dispersion of the formulation away from the site of deposition. In the example illustrated above, Formulation (b) displayed a longer residence time compared to Formulation (a).

Regions of interest can be drawn around the nasal cavity and the nasopharyngeal area. The radioactive counts in the regions of interest enable calculation of the clearance



Inhaled Delivery



The in vivo behaviour of liquid or powder preparations administered from a variety of MDI or DPI devices, or directly from solution via nebulisation, can be visualised using gamma scintigraphy.

Deposition patterns can be strongly influenced by formulation factors and inhaler device design characteristics as well as by the patient's ability to use the inhalation system correctly.

This is illustrated in this example of a nebulisation study. Image (a) shows that deep lung delivery was achieved with an inhaled gas (^{81}Kr). This patient had considerable difficulty in coordinating breathing during nebulisation resulting in poor delivery of the drug to the alveolar region of the lung, as seen in image (b).

