

# Nasal mucociliary clearance and mucoadhesion of hydroxypropylmethylcellulose powder used for alleviation of allergic rhinitis

Bernadette Diethart<sup>1</sup>, Jean Emberlin<sup>2</sup>, Richard Lewis<sup>3</sup>

## Background:

An inert hydroxypropylmethylcellulose powder (Nasaleze<sup>®</sup>) has been used since 1994 in the alleviation of allergic rhinitis (AR). The powder is applied to the inside of the nose where the particles adhere to the nasal mucosa, absorb moisture and swell to form a gel. Its efficacy in reducing hay fever symptoms and its barrier function against Der p 1 allergen have been recently proven. Mucoadhesion and clearance of the gel influence the duration the barrier is efficient.

## Methods:

For the investigation of the effect of HPMC application on mucociliary clearance a modified Andersen saccharine test was applied. Twelve healthy volunteers were tested after the end of the grass pollen season 2008. In order to test the baseline mucociliary clearance time (MCT) of each participant, saccharine solution (3 %) was applied to the anterior tip of the inferior turbinate in one nostril of the subjects by means of rayon tip swabs. The subjects were instructed not to sniff or sneeze and to report a sweet taste as soon as it was noted and time was measured from the moment of solution application. After baseline measurements, 10 mg and 20 mg of HPMC was sniffed into the same nostril. After 5 minutes to allow gel formation the Andersen test procedure was repeated.

## Results:

The mean mucociliary clearance time at baseline was 11.14 minutes. This baseline MCT significantly increased to 35.45 minutes when 10 mg of HPMC were applied to the nostril prior to the test ( $p < 0.0005$ ). Application of 20 mg resulted in a mean MCT of 50.37 minutes and thus a further increase  $>120\%$  ( $>420\%$  longer MCT compared to baseline). This elongation of MCT was statistically significant when compared to baseline and 10 mg HPMC ( $p < 0.0005$ ).

## Conclusion:

Mucus maintains a hydrated layer over the epithelium which serves as a protective barrier against pathogens and noxious substances. However, the mesh spacing of mucus is too large to constitute a diffusion barrier to most allergens. HPMC gel applied to the nose has been proven to be a barrier to allergen entry. The attachment of HPMC to nasal mucus (mucoadhesion) slows down nasal clearance which enables longer residence time of HPMC in the nose and thus increases the time HPMC can be effective as a barrier before it is cleared. Also, dehydration of mucus while the HPMC gel forms increases mucus viscosity, which might decrease the diffusion coefficient through the mucus resulting in lower allergen diffusion.

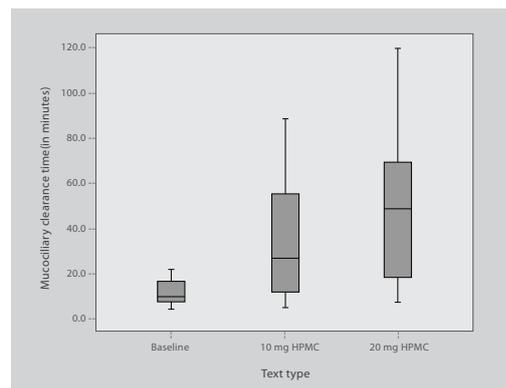


Figure 1: Boxplot of baseline MCT and MCT after nasal application of 10 mg and 20 mg of HPMC.

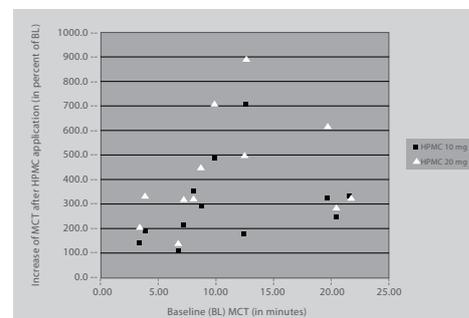


Figure 2: Relationship between initial MCT at baseline and degree of subsequent MCT increase after HPMC application.

	Women	Men
Number of participants	9	3
Mean age (in yrs)	32.8	37.0
Age range (in yrs)	25-40	25-60
Allergic rhinitis during last two yrs	3 (33.3 %)	1 (33.3 %)
Smoker	1	1

Table 1: Demographics of participants recruited for Andersen saccharine testing.

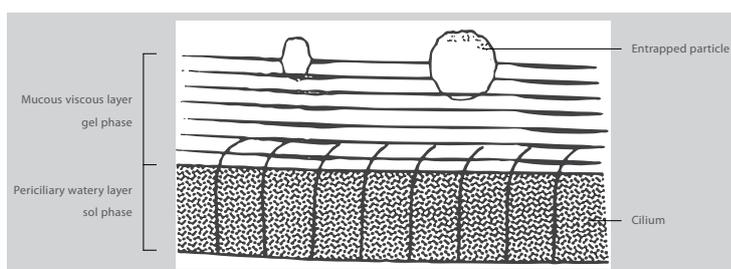


Figure 3: Viscous gel phase and periciliary fluid forming the mucus double layer (modified according to Quraishi et al. 1998).