

The best method of topical nasal drug delivery

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The 'best method' of topical nasal drug delivery: comparison of seven techniques

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INTRODUCTION

- Based on a review of the literature, the American Academy of Otolaryngology-Head and Neck Surgery Foundation has tried to define the best technique of administering intranasal corticosteroids, Unfortunately, they failed to provide the definitive conclusions

- Reaching the middle meatus is of importance when treating both nasal polyposis and chronic rhinosinusitis but individual anatomical and physiological differences challenge nasal drug delivery to this area
- In this study, comparison of four nasal drug delivery techniques currently in use and tried to define the best technique for administering intranasal corticosteroids

- They investigated three new techniques for topical nasal drug delivery. These new techniques used the single-unit dose nasal spray, a known intranasal drug delivery device, re-designed to overcome the role of gravity and combining the advantage of a spray mechanism with the possibility of delivering drugs in non-upright head positions.

MATERIAL AND METHODS

- Healthy volunteers were recruited
- Volunteers with frequent epistaxis, a history of smoking, an absent middle turbinate or a severe DNS (defined as severe enough to prevent visualisation of the anterior end of the middle turbinate without decongestion) were excluded.
- Volunteers taking medications (corticosteroids, antibiotics) , volunteers having difficulties in assuming the different head positions for administration were excluded.

Test drug formulation for spray and drop

- The same dyed formulation was used in each test
- The content of fluticasone nasal drops Flixonase nasules[®] (1 mg/ml), was used as the test formulation and dyed with 0.1% methylene blue
- In order to guarantee comparable volumes of test formulation in all test situations, the usual daily dose of fluticasone in a metered atomizing nasal spray (Flixonase[®], GlaxoSmithKline), 2 puffs each nostril, (approximately 0.18ml) was used as the standard test volume.

Delivery modes

- *Nasal sprays*: Head in Upright position (HUR)
- the unit-dose spray: three different head positions were tested
- *Nasal drops*: Three different head positions were tested

Head positions

- Head upright (HUR): This position is widely used for all multidose container sprays.
- Lying head-back position (LHB): Lying down in supine position with the head just off the bed in hyperextension, so that the chin is the highest point of the head. “Proetz or Mygind position”
- Lateral head-low position (LHL): Lying on the side with the parietal eminence resting on the bed. The nasal formulation is administered to the lower nostril.

- Head down and forward (HDF), also known as 'Praying to Mecca': Kneeling down, placing the top of the head on the ground and the forehead close to the knees with the nostrils facing upwards.

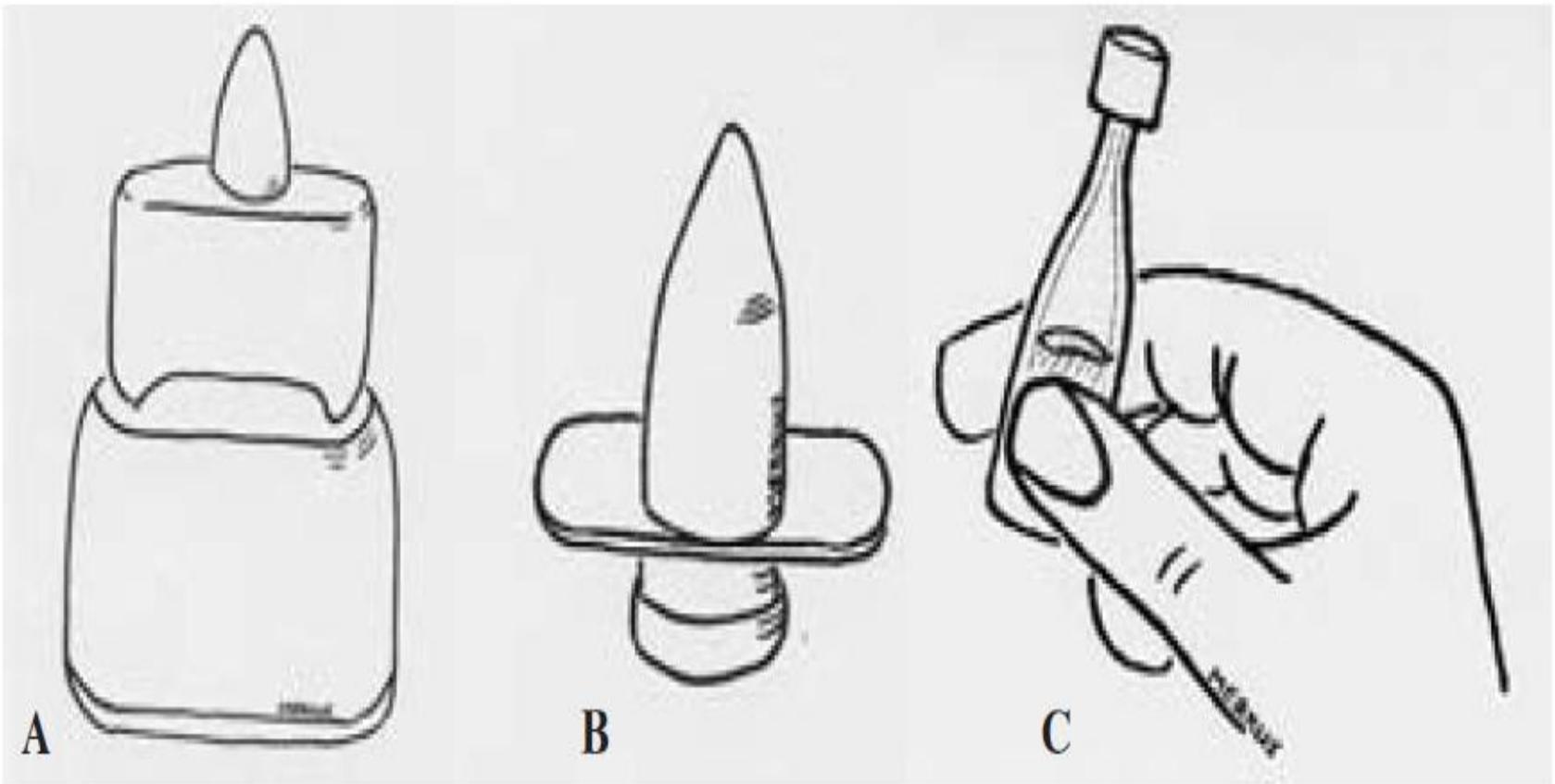
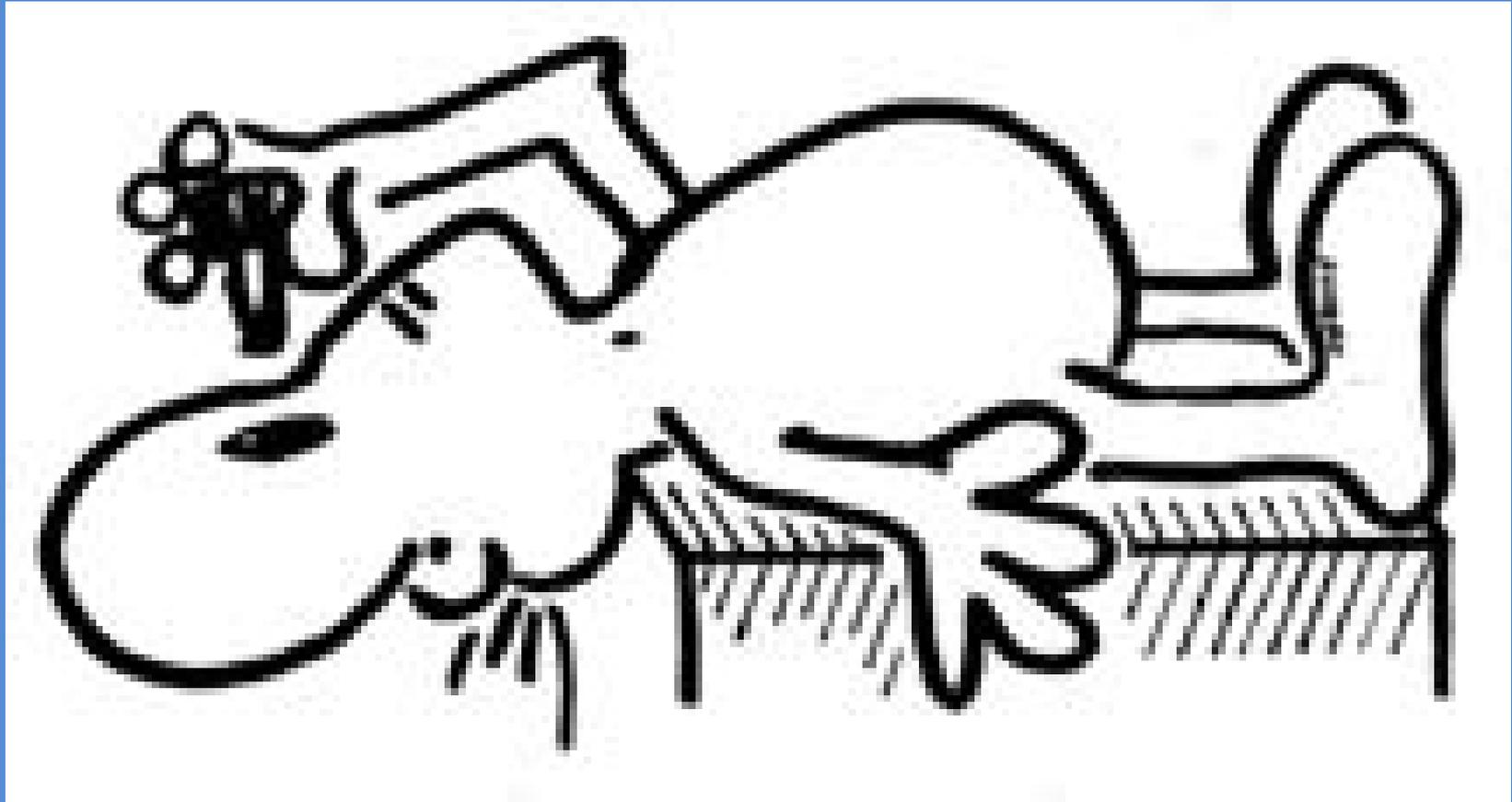
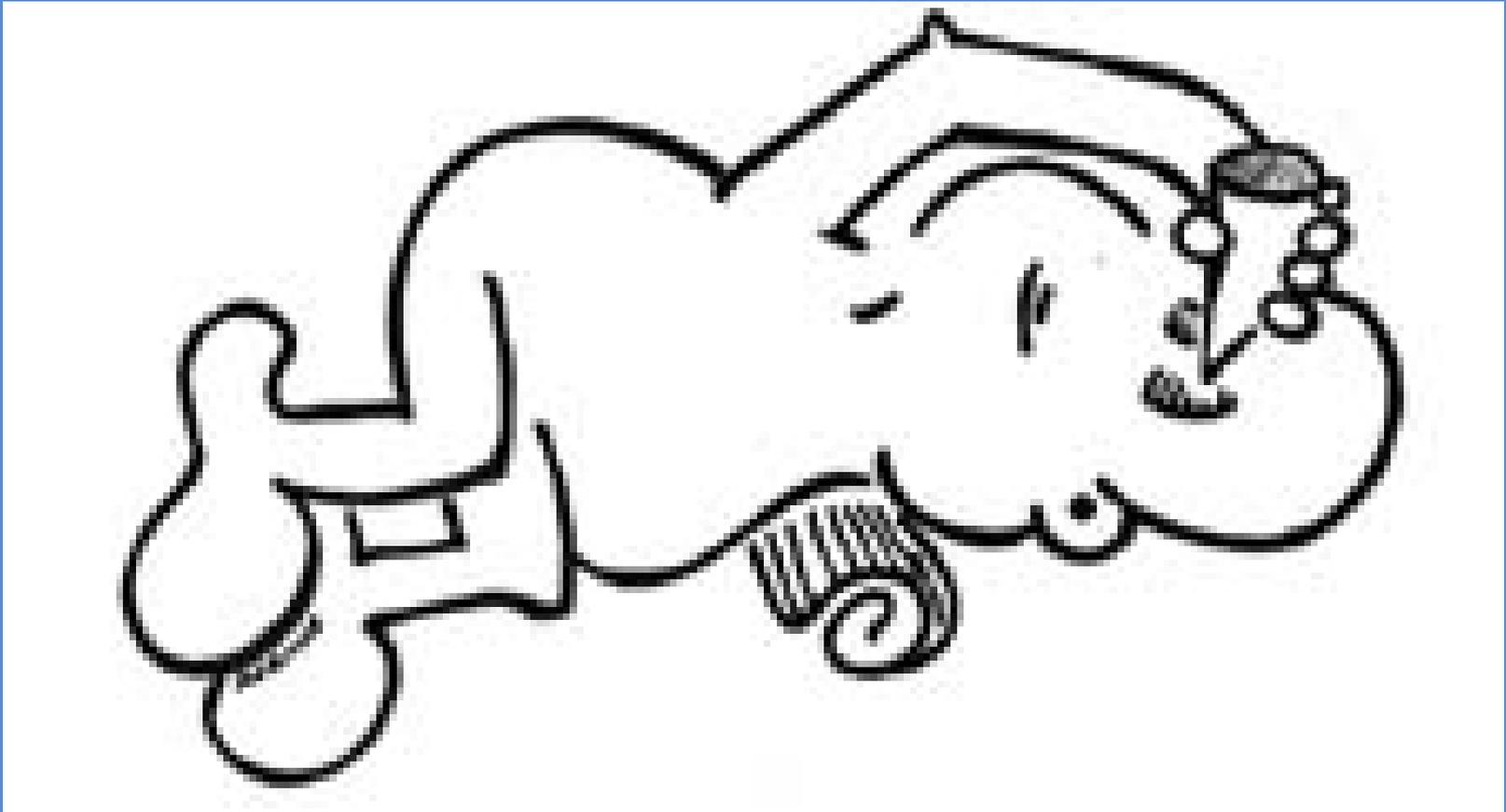


Figure 1a-c. Three drawings showing the devices used. a.. Container spray, a multidose spray, used in one head position; b. Unit-dose spray, an 'one time use' spray functional in different head positions; c. Nasule, an 'one time use' plastic container, used in different head positions.

Lying head-back position (LHB)



Lateral head-low position (LHL)



Head down and forward (HDF)



Summary of the seven techniques used

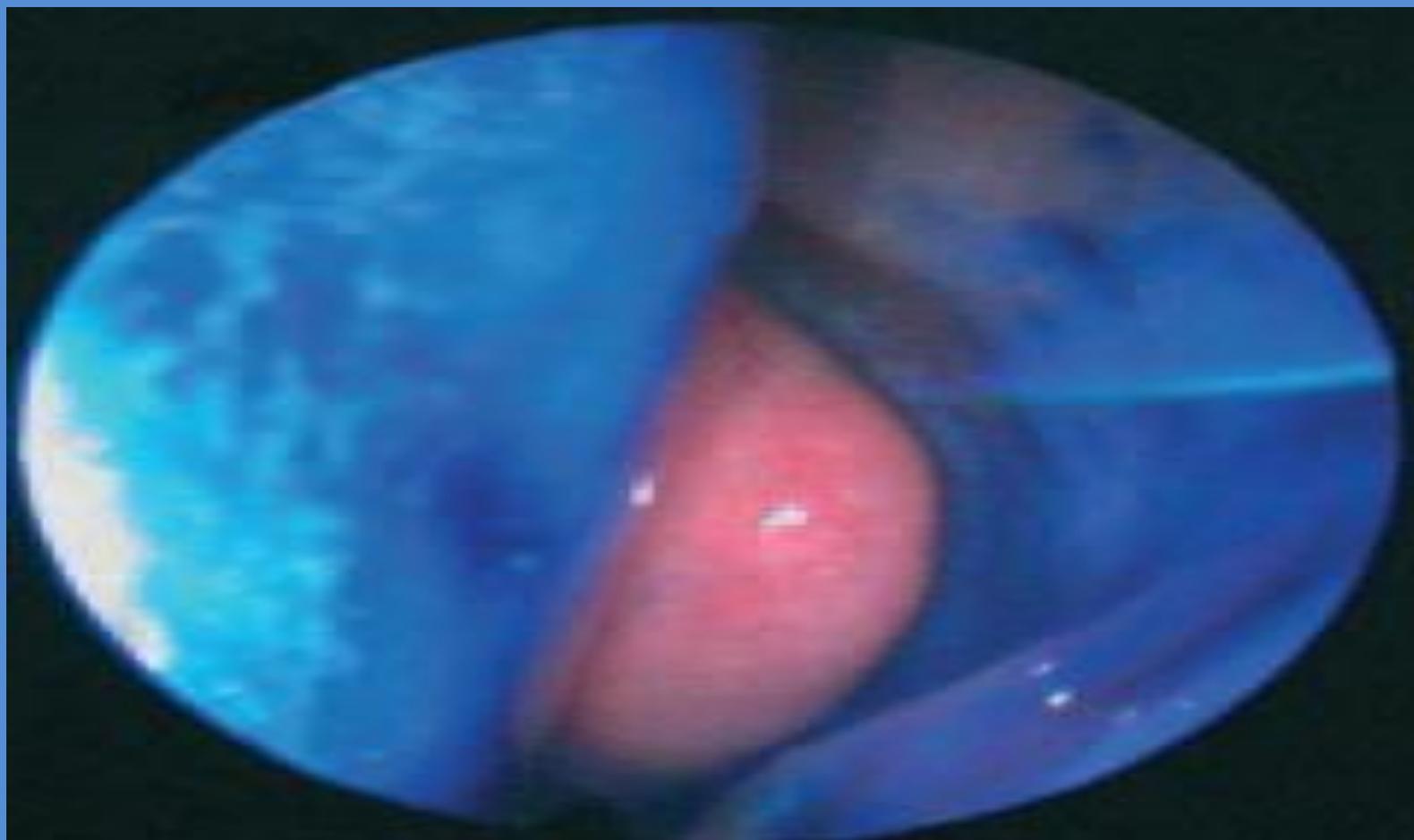
Device	Container Spray	Sprays			Drops		
		Unit-dose Spray			Nasal Drops		
Head Position	HUR Head UpRight	LHB Lying Head Back	LHL Lateral Head Low	HDF Head Down Forward	LHB Lying Head Back	LHL Lateral Head Low	HDF Head Down Forward

Study design

- Single-blind randomized crossover study using seven different nasal drug delivery techniques
- Each volunteer was tested on seven non-sequential days

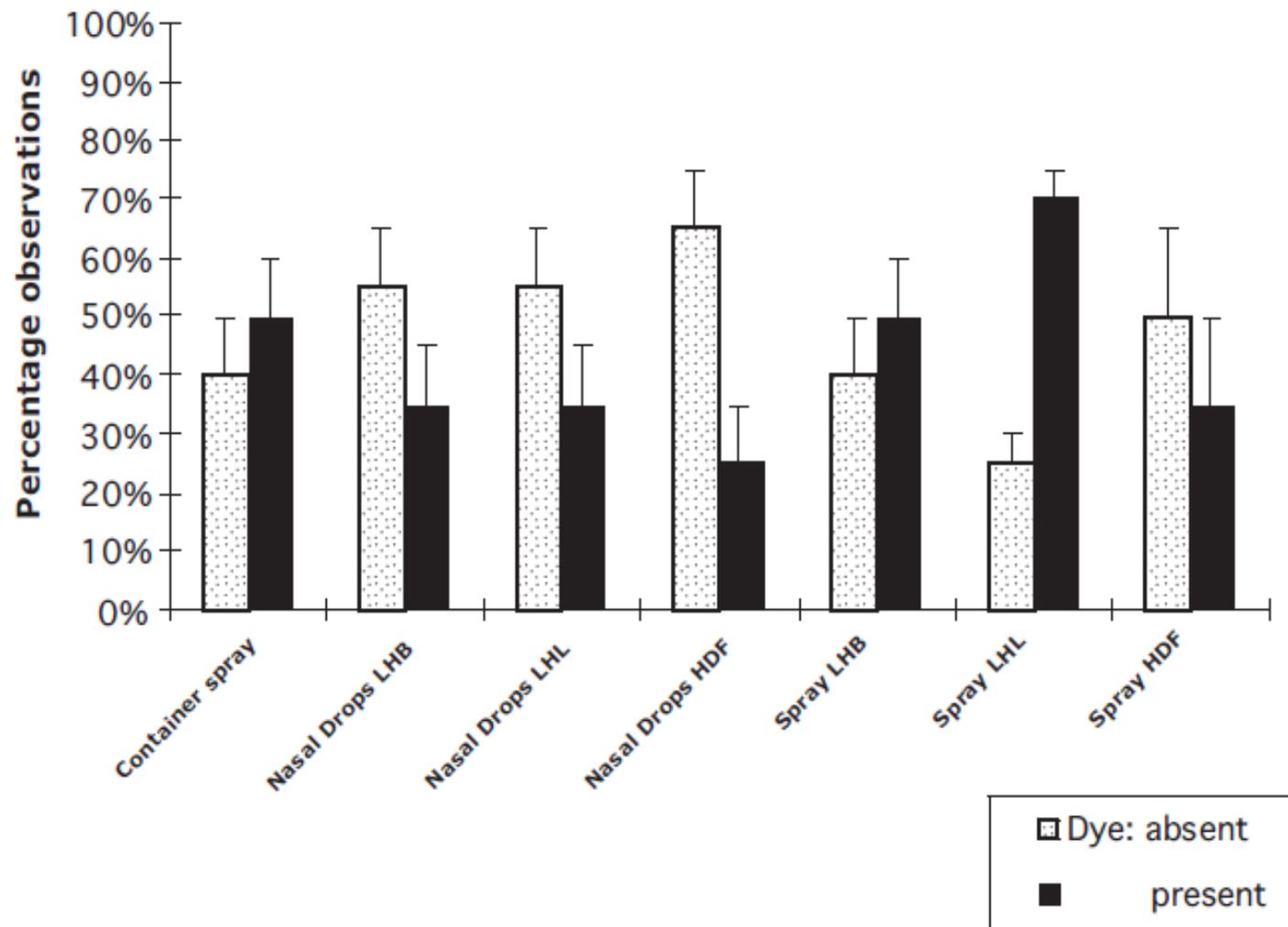
- The delivery of dyed test formulation was directed towards the lateral epicanthus of the ipsilateral eye.
- Volunteers were not allowed to deliver the test formulation themselves.
- After administration, each volunteer had to remain in the position in which drugs were delivered for 60 seconds.

- In an adjacent room, a second, ENT physician, performed nasal endoscopy within three minutes after the administration of dyed test formulation.



Video analysis

- The deposition of dyed test formulation was scored as either 'head of the middle turbinate not visible' (not on the video/poor view), 'absence of dye' or 'presence of dye'.
- The videos in which the middle turbinate was not visible were excluded from the analysis results



RESULTS

- Statistical analysis revealed no significant difference between the amounts of drug delivered near the head of the middle turbinate ($p=0.115$)
- Although not significant, a clear improvement in deposition near the head of the middle turbinate using the single-unit dose nasal spray was observed for all techniques.
- The single unit-dose nasal spray was superior to nasal drops in all head positions used. This difference attained significance when all observations for both delivery devices were taken together

Discussion

- Nasal drug delivery is a multifactorial process and therefore hard to investigate. Individual anatomical differences, different head position, the type of drug formulation, drug volume and different delivery devices all affect topical nasal drug delivery

- the single-unit dose nasal spray was on the whole superior to nasal drops.
- This spray could be a promising new device for topical nasal drug delivery, but additional testing will be required to establish the true value of this device.
- The longer tip of this nasal spray (bypassing the nasal valve area and vestibule hairs), the higher velocity of administration (to increase penetration) and the possibility of directing drugs may account for these differences

- The study reveals that all head positions commonly used for the delivery of drugs in nasal drops are equally effective, although a slight trend in favour of the LHB and LHL head position was observed

- Drug delivery to the nose via the HDF head position revealed that drugs are delivered at more cranial locations
- This head position may, therefore, be useful in the treatment of nasal polyps located superior to the middle meatus or in reaching the olfactory region.

Conclusion

- From the study, they conclude that topical nasal drug delivery is multifactorial and hard to investigate, and that the identification of a single 'best technique' for topical nasal drug administration is unrealistic. A more individual approach to topical nasal drug treatment, taking anatomy and head position into account seems more appropriate.

Thank you