Automated dander dispersal in a cat Naturalistic Exposure Chamber

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Abstract

Allergen exposure chambers (AEC) provide controlled allergen exposure to allergic subjects for the clinical study of asthma and allergy. They should ideally mimic natural allergen exposure, and provide better control of allergen exposure than possible in field studies. For AEC exposure to cat allergens, typically, either liquid allergen extract is nebulized, or natural cat hair and dander are aerosolized by shaking cat bedding. While bedding shaking is more naturalistic than liquid extract exposure, it results in high variability of allergen levels. We have developed an automated method of natural dander dispersal that uses robotic vacuum cleaners with filters removed and modified for variable suction. The system was validated in two rooms (14.4 m3 and 36.7 m3) where two cats reside. The vacuums aerosolize aspirated dander that has naturally accumulated on the floor. Dispersion was characterized by measured airborne allergen (Fel d 1) and particle sizes and concentrations in time and space during 1 and 2-hour tests. At optimized parameters, Fel d 1 was found to be stable in time (2 hours), and homogenous throughout the rooms. Average Fel d 1 was 55 (±9 SD) ng/m3 in the smaller room and 79 (±30 SD) ng/m3 in the larger room, which are comparable to exposure in homes with cats. This novel method of dander dispersal provides controlled, safe exposure to cat allergens in a clinical setting, while maintaining the naturalistic advantages of a field exposure.

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