

Environmental Controls in Reducing House Dust Mites and Nasal Symptoms in Patients with Allergic Rhinitis

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Abstract

A randomized comparison group pretest-posttest experimental design was used to quantitatively determine the effects of environmental control measures on patients with allergic rhinitis. Environmental controls included wrapping the mattress with a vinyl cover, washing the top bedding cover with 55°C hot water every two weeks, removal of soft furniture, and wet cleaning of the bedroom floor every day. Thirty subjects were randomly assigned to experimental and control groups. The amount of house dust mites in dust samples collected from the bedroom floor, bedding and mattress, as well as the nasal symptoms of patients, were measured twice at one-month intervals. A significant decrease in house dust mites in dust samples and relief in patients' nasal symptoms were observed in the experimental group who had environmental controls.

Key Words: Environmental control, allergic rhinitis, house dust mites, nasal symptoms

INTRODUCTION

Allergic rhinitis is the one of the most prevalent atopic diseases. Ten percent of the worldwide population and 13% of Koreans aged 7–18 are affected by allergic rhinitis and the prevalence continues to rise.¹ Most case of allergic rhinitis in Korea are perennial ones caused by house dust mite allergens and can be effectively managed by decreasing exposure to house dust mites through environmental controls.²

Environmental controls are considered a primary treatment for house dust mite allergy.³⁻⁷

Clinical trials have reported some success using chemical control methods, in terms of both mite reduction and clinical improvement.⁸⁻¹⁰ But the application of chemicals is highly laborious, it has only temporary effects, it is toxic for humans, and it is very expensive.¹¹

Physical methods of mite control, such as regular vacuum cleaning and wrapping mattresses with vinyl

covers help to reduce allergen accumulation, but it is generally agreed that alone they will not lead to a substantial reduction of allergen.

The goal of environmental controls is to make the environment as hostile as possible for dust mites, by applying as many measures as are practical, physically and economically, for the family.⁵ Not all measures are feasible for every family situation. We conducted this study to find more economical, feasible and effective ways to relieve nasal symptoms in patients with allergic rhinitis through examination of the effectiveness of environmental control measures.

The hypothesis for this study was:

Patients with allergic rhinitis who receive environmental control for allergen avoidance measures have fewer house dust mites and lower nasal symptom scores than those who receive only routine care.

MATERIALS AND METHODS

Research design

A randomized comparison group pretest-posttest experimental design was used to quantify the effects of an environmental control program in bedrooms on the amount of house dust mites and nasal symptoms in patients with allergic rhinitis.

Only routine verbal instruction was given to the

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control group, while four weeks of environmental control was provided to the experimental group by a researcher in addition to routine care. After the collection of posttest dust samples, the same control measures were provided to the control group.

The environmental control in this study was confined to a patient's bedroom in the patient's home and environmental control consisted of wrapping the mattress with a vinyl cover, washing the top bedding cover with 55°C hot water every two weeks, removal of soft furniture and wet cleaning of the bedroom floor every day.

To confirm the effectiveness of environmental controls, the patients' nasal symptoms and the amount of house dust mites were measured.

Subjects and samples

The subjects were enrolled from patients visiting the allergy clinic of a university hospital. An allergy clinic nurse selected 30 patients based on their lack of knowledge and practice regarding environmental controls as well as their agreement to participate in this study. They were randomly assigned to one of two groups, experimental (n=15) and control (n=15). All the patients satisfied the following criteria prior to receiving environmental control. The patients had allergic rhinitis caused by house dust mites revealing higher than +++ at skin prick test and radioallergorbent test, whereas skin test to other common inhalant allergens were negative. Total subjects consisted of 29 patients because one subject in the control group failed to complete the study. Subjects ranged in age from six to 31, with a mean age of 15.6. Gender representation was 41.4% female and 58.6% male. Their medical treatment, including immunotherapy (51.7%) and medication for relieving symptoms (27.6%), was continued. None had a carpet or air-conditioner in their bedrooms.

The dust samples were collected from each subject's bedroom floor, bedding and mattress by a researcher before and after environmental control. To prevent bias in the sample collection, all the procedures were conducted under the same conditions; the same researcher collected dust for 2 minutes/square meter, in the morning before cleaning the room with an electric vacuum cleaner (VP-880, Samsung Electric Co., Korea) fitted with a double-layer domestic tissue filter. The filters were stored in sealed plastic bags at -20°C

Table 1. Scoring of Nasal Symptoms

Sneezing	
0	No sneezing attacks
1	1-5 sneezing attacks
2	6-10 sneezing attacks
3	more than 10 sneezing attacks
Rhinorrhea	
0	No nose blowings
1	1-5 nose blowings
2	6-10 nose blowings
3	more than 10 nose blowings
Nasal obstruction	
0	No nasal obstruction
1	Nasal obstruction without mouth breathing
2	Nasal obstruction with sporadic mouth breathing
3	Nasal obstruction with predominant mouth breathing

Adopted from Okuda et al.¹³

before identification of mites. The data were collected between July and October, 1995.

Measurements

The amount of mites: One gram of house dust in each filter bag from vacuum cleaners was weighed and decolorized with soaking lactophenol for four days. Mites were detected under a stereo microscope. The collected mites were mounted on a slide with Hoyer's solution and identified by a 400× microscope according to the methods of Identification of Domestic Mite¹² by an expert entomologist. All identified mites were counted and classified by family group.

Nasal symptom: The clinical evaluation of allergic rhinitis symptoms was performed by a nurse according to the criteria of Okuda et al.¹³ in order to avoid bias in the assessment of outcomes. The daily symptoms included the number of sneezing attacks, number of nose blowings, and degree of nasal obstruction, and then the three nasal symptoms (sneezing, rhinorrhea, and obstruction) were graded on a scale of 0 to 3, depending on severity (Table 1).

Data analysis

Chi-square test with Yates correction for small numbers was performed to compare the demographic characteristics.

Means, medians and ranges of the amount of house dust mites and nasal symptom scores were computed.

Table 2. Demographic Characteristics of the Experimental and Control Groups

Characteristics	Experimental (n=15) No (%)	Control (n=14) No (%)	Total (n=29) No (%)	P
Gender				
Male	10 (66.7)	7 (50.5)	17 (58.6)	0.362
Female	5 (33.3)	7 (50.5)	12 (41.4)	
Age (yrs)				
≤ 19	10 (66.7)	7 (50.5)	17 (58.6)	0.362
≥ 20	5 (33.3)	7 (50.5)	12 (41.4)	
Family History				
Yes	13 (86.7)	12 (85.7)	25 (86.2)	0.940
No	2 (13.3)	2 (14.3)	4 (13.8)	
Medical Treatment				
Immunotherapy	8 (53.3)	7 (50.0)	15 (51.7)	0.546
Symptomatic medication	5 (33.3)	3 (21.4)	8 (27.6)	
None	2 (13.3)	4 (28.6)	6 (20.7)	
Duration of Allergic Rhinitis (yrs)				
≤ 3	5 (33.3)	2 (14.3)	7 (24.1)	0.065
4-5	6 (40.0)	4 (28.6)	10 (34.5)	
≥ 5	4 (26.7)	8 (57.1)	12 (41.4)	

Table 3. Total Amount of House Dust Mites by Family Group (/gm)

Family	Number of mite (%)
Pyroglyphidae	1,321 (88.1)
Acaridae	68 (4.2)
Mesostigmata	240 (14.7)
Total	1,630 (100.0)

Wilcoxon rank sum test and Wilcoxon signed rank test were used to test the hypothesis at the .05 level.

RESULTS

There were no significant differences between the experimental and control groups on variables of demographic characteristics (Table 2).

The amount of house dust mites

Total 1,630 mites were counted from 1 gram of 58 dust samples and 3 families were identified as shown in Table 3. The Pyroglyphidae family was

predominant with 88.1% of the total, followed by Mesostigmata with 14.7%. The smallest was Acaridae with 4.2%.

Comparison of the amount of house dust mites

The means, medians and ranges of the amount of house dust mites before and after environmental control are shown in the Table 4.

The amount of house dust mites was significantly reduced after the environmental control from 44.1 to 11.6 ($p=0.0394$).

The difference in the amount of house dust mites before and after environmental control between the experimental and control groups was significantly different (-32.5 versus 15.8 , $p=0.0342$).

Comparison of the severity scores of nasal symptoms

As shown in Table 5, the mean nasal symptom score was significantly reduced after the environmental control from 5.0 to 2.1 ($p=0.001$).

The difference in the nasal symptom score before and after environmental control between the experimental and control groups was significantly different

Table 4. Changes in the Amount of House Dust Mites Before and After Environmental Control (/gm)

Group (N)	Before			After			Difference (After-Before)		
	Mean	Median	(Range)	Mean	Median	(Range)	Mean	Median	(Range)
Experimental (15)	44.1	12.0	(105.0)	11.6	1.0*	(42.0)	-32.5	-7.0	(113.0)
Control (14)	19.7	6.5	(48.0)	35.6	8.5	(121.0)	15.8	1.5	(148.0)

* $p < 0.05$.

Table 5. Changes in the Severity Scores of Nasal Symptoms Before and After Environmental Control

Group (N)	Before			After			Difference (After-Before)		
	Mean	Median	(Range)	Mean	Median	(Range)	Mean	Median	(Range)
Experimental (15)	5.0	5.0	(7.0)	2.1	2.0	(6.0) †	-2.9	2.0	(7.0)
Control (14)	4.2	3.0	(7.0)	3.9	3.5	(6.0)	-0.3	0.0	(10.0)

* $p < 0.05$, † $p < 0.001$.(-2.9 versus -0.3, $p = 0.0255$).

DISCUSSION

Most environmental control measures are not difficult to carry out and they are harmless and inexpensive compared to other treatments. However, implementation of environmental controls for mite allergen avoidance depends on the ability of patients and their families. Among the various allergen avoidance measures we used the combined physical environmental control measures which are simple and easy to carry out, economically affordable and harmless for the patients. The environmental control in this study was confined to the patient's bedroom in the patient's home. Since a bedroom is generally the most important room in the home for mites, bedding is not only a prime breeding area but it is also a good place for their habitation. As well, patients spend a large amount of time in the bedroom. Murray and Ferguson¹⁴ insisted that under some circumstances, radical measures in the bedroom alone can be effective.

To prevent the release of mites, we adopted vinyl covers which are common, inexpensive and easily obtainable. To eliminate the mites, we used hot water

washing, because most Koreans are accustomed to wet cleaning and to washing the top bedding in boiling detergent water. All participants had no problems in performing the measures, except in maintaining the regular laundry. To determine the effect of environmental controls, the amount of mites was employed as an objective parameter because it is less expensive than measuring the level of antigen, which is the most sensible and valid indicator. Some previous surveys have revealed a positive relationship between mite counts and the degree of allergy.^{15,16}

We could detect not only the differences in the amount of mites between the experimental and control groups, but also observe that the amount of mites in the experimental group decreased significantly as a result of the environmental control measures. These results are similar to those of other studies. In those studies, the level of antigen decreased after improving the hygienic conditions of allergic patients following a physician's advice,¹⁷ wrapping the mattress combined with laundering bedding in hot water every week,¹⁸ and encasing the mattress after chemical treatment plus hot-water washing of bedding every two weeks.¹⁹

After one month of environmental control measures, the nasal symptoms of the subjects in the experimental group significantly improved compared

to those in the control group and pretest ones. The nasal symptoms were relieved following the environmental control measures in 12 of 15 patients (80.0%) in the experimental group. This outcome was similar to those in other studies which showed that one month of environmental control measures were effective in improving asthma patients symptoms, and that their allergic symptoms were relieved under the improved environmental conditions.¹⁷

The amount of house dust mites in Korea begins to increase in July and reaches its peak in October. The increase in the amount of mites in the control group seems to be due to the fact that the study was conducted from July to October or the lack of environmental control. The study also yielded conflicting results; despite the increasing amount of mites in the control group, nasal symptoms were not changed. This is presumably because of the effects of treatment, since symptomatic medication was continuously under taken during the experiment.

These results implied that routine verbal instruction was not enough to practice allergic avoidance measures for patients or their families. Perhaps they need more details about allergen avoidance measures or some strong motivation to practice them. They need additional care for practice, such as assessment of their comprehension of given instructions, and for follow-up to determine supplemental and reinforcing care. A previous study suggested that computer-assisted reinforcement of instruction can provide a standardized, interactive supplement to traditional instruction. Also, according to the study, it may be useful to employ a questionnaire such as the self-rating scale in follow-up to determine which allergen avoidance measures subjects have implemented, or it may be helpful to make a home visit to assess the environment.¹⁰ In addition to this, a standardized teaching handout or videotape containing instructions on environmental control, as well as telephone contacts, are good educational intervention suitable for Koreans with allergic rhinitis.

We concluded that environmental controls such as wrapping the mattress with a vinyl cover, washing the top bedding cover with 55°C hot water every two weeks, removal of soft furniture, and wet cleaning of the bedroom floor every day were effective for the management of house dust mites in sensitized allergic rhinitis patients, and in reducing the amount of house dust mites. We propose that the combined environ-

mental control measures provided in this study may be useful and of benefit to individuals with allergic rhinitis.

Since this study has the limitation of a small sample size, it is recommended that further studies extend such interventions with larger and broader samples.

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