The importance and efficacy of the AirNettress, sleeping surface in preventing dust mite exposure

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The incidence of allergic disease and especially asthma, allergic rhinitis and atopic dermatitis is constantly rising. The prevalence of asthma is approximately 8-15% of the population and approximately 20-40% suffer from allergic rhinitis, especially children and young adults.[1] [2] Allergic diseases are caused by the host's immunological response, primarily via IgE antibodies to environmental antigens and treatment is based on three principles:

a. Environmental control with prevention or decrease of exposure to allergens.
b. Pharmacological treatment of symptoms and/or their prevention.
c. Immunotherapy against environmental allergic triggers.

Allergens are antigenic proteins that enter the body by nasal and oral breathing and at times through the skin and gut barriers. Important aeroallergens are tree, grass and weed pollens, animal dander and molds but the most important are house dust mite (HDM) allergens. Dust mites are arthropods, related to ticks, chiggers and spiders and are too small to be seen with the naked eye and include 10 species. The two most common are Dermatophagoides pteronyssinus and D. farinae. For optimal growth HDMs require high humidity, moderate temperature (21-27°C) and adequate food source such as human skin scales. The largest numbers of mites are usually found in dust samples taken form uncovered mattress surfaces, bedding, upholstered furniture and floor carpeting.[3,4,5] The upsurge of allergic disease during the last decades is associated with the rise in exposure to HDMs due to increased heating and humidity, decreased aeration of houses, growing use of upholstered furniture and beds and the increasing time spent indoors. Many studies have shown that the prevalence of dust mite sensitization reaches 65-95% of children and adults with allergic diseases.[6,7,8] In Israel, the sub-tropical climate combined with the western life style has increased the prevalence of HDM exposure and sensitization and epidemiological and clinical studies have shown their significance in allergic diseases.[9,10,11]

The correlation between dust mite exposure, development of allergic disease and asthma and exacerbation of disease has been documented in many studies. Sensitization to HDM has been found to be an important risk factor in the development and persistence of asthma.[12,13,14] Exposure to HDMs begins in infancy and significant levels have been showed in infant beds.[15] Due to the significant correlation between HDM exposure and allergic disease and asthma many studies have been carried out in order to examine the hypothesis that prevention of HDM exposure may decrease the development and exacerbation of allergic diseases:

The *Study of Prevention of Allergy in Children in Europe* assessed the affects of anti-HDM measures, such as mattress covers and environmental control measures on the development of sensitization to the allergen. A significant decrease in sensitization was found in the study population and environmental control was found to have a positive affect on prevention of development of allergic disease.[16]

The *Manchester Asthma and Allergy Study* examined the use of special mattress covers and special cleaning and vacuum cleaners and showed a significant decrease in the occurrence of asthma and wheezing in infants and children.[17]

In the *Prevention and Incidence of Asthma and Mite Allergy Study* the affect of environmental control on clinical allergic disease in infants was investigated. Nocturnal cough in the study population was significantly reduced in comparison to the control population. [18]

Similar results were found in many other studies in which the effects of both environmental and nutritional measures were examined and a positive affect of HDM control measures on future development of allergic disease was found.[19,20,21,22,23,24,25]

In spite of the fact that most studies showed positive affects of HDM control on development of allergic disease some studies showed a limited or complete lack of affect.[26,27] One of the main reasons for the lack of consistency of the results is the difficulty in implementation of environmental control measures. Such measures include life style changes, increasing the frequency of clothes laundering and the use of additional equipment such as filters, vacuum cleaners and bed covers. When used correctly and efficiently, incorporation of environmental control measures have a positive affect on allergic disease.[28,29] In addition, it has been found that environmental control measures have to be tapered specifically for the child according to his sensitivity and the environment he lives in. An example is a study on 937 asthmatic children in whom specific environmental control measures were used for every child and house and a significant decrease in HDM levels were found which correlated with a reduction of asthma morbidity during and one year after the study.[30,31,32,33]

One of the important factors in success of environmental measures is early implementation, before the appearance of target organ involvement. Many experts state that such measures should be used from early infancy and the earlier implemented the better the results.[34,35] Infants spend most of the time in the crib and bed but in spite of the parent's natural concern about the cleanliness of their child's sleep environment high levels of HDMs were found in infant cribs.[15] Concern regarding the possibility of toxic substances and allergens in the infant mattress or immediate sleep environment as a factor in the sudden infant death syndrome (SIDS) were raised by some investigators.[36'37] One of the etiologies of SIDS which was mentioned by some investigators was and allergic reaction and an association between SIDS and sleeping on used mattresses was found.[37-40] In contrast to blankets, sheets and pillow covers which are washable, mattresses are not and the technical difficulty in cleaning them has lead to the conclusion that the only method of preventing exposure is by the use of impermeable covers. Only highly impermeable covers, which are usually uncomfortable, can prevent HDM allergen infiltration through the sheet.[41]

In order to prevent the accumulation of Hems in infant mattress, The Child Development Company developed a new sleeping surface, AirNettress which is based on a porous netting stretched over a wooden or aluminum frame devoid of any filling. This creates a sleep surface which is completely permeable to air and prevents any accumulation of dust or HDMs. In a study performed by Dr Costa Mumcuglu, from the Parisitology Laboratory, Hadassah Hospital Medical School, Jerusalem, Israel, HDM survival on the new surface was compared to survival on standard mattresses. Dust mites, grown in culture, were placed on the experimental sleep surface and the control standard mattresses. The study and control mattresses were placed in standard conditions for HDM growth and after one week HDM numbers were compared.

HDM's could not survive on the experimental sleep surface whereas the mites not only survived but reproduced and proliferated on the standard mattresses.

In summary:

- HDM is the most important allergen that causes allergic disease and asthma.
- Prevention of exposure to dust mites has a major role in primary and secondary prevention of allergic diseases.
- Prevention is most important in infancy and childhood, at which time the allergic diseases begin to peak and preventative measures have the most significant affect.
- HDM removal from mattresses is a significant problem.
- The new, netted, sleep surface, AirNettress, is built in such a way as to prevent completely survival and reproduction of HDM on it. This observation was proven in a controlled laboratory study.
- Use of the new sleeping surface can most probably inhibit exposure of infants to HDMs in the immediate sleep environment, prevent the development of sensitization to HDM and prevent morbidity from allergic diseases.

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