# Comparison of Multi-Test device skin testing and modified RAST results

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**The initial purpose of this study was to determine the potential correlation between allergy test results obtained with the Multi-Test skin testing method and the radioallergosorbent test (RAST) blood test (used as a "standard"). Twenty patients with a history and physical examination findings suggestive of inhalant allergy underwent both a Multi-Test system screen (14 antigens plus histamine and glycerine controls) and RAST testing. The relationship between wheal size and Multi-Test system grade for each antigen and the corresponding RAST class was studied. The correlation between positive Multi-Test system and RAST results was poor, with an average agreement by antigen of 56.26% and overall agreement of 67.86%. However, the overall agreement between negative Multi-Test system results (≤1+) and negative RAST results (≤class I) was 95.15%, with an average agreement by antigen of 83.99%. On the basis of results of this preliminary study, it appears that a negative Multi-Test system result indicates that significant inhalant allergy is unlikely, whereas a positive Multi-Test system result necessitates follow-up with more definitive testing by additional skin testing or RAST.** (Otolaryngol Head Neck Surg 1998;118:797-9.)

Testing for inhalant allergy may be done in a number of ways. The traditionally accepted method is by skin testing, which in turn may take the form of intradermal or epicutaneous (skin prick) tests. Prick testing, a standard for allergy diagnosis since the work of Lewis and Grant[1] in 1926, is typically a first step in screening by the general allergist, because it readily identifies patients with high degrees of sensitivity who are at risk for anaphylaxis if subjected to single-dilution intradermal testing. This type of test carries a significantly lower risk of systemic reaction than intradermal testing, although the latter is said to be more sensitive for the diagnosis of low degrees of sensitivity. Otolaryngologic allergists perform intradermal testing without antecedent prick testing, beginning at an anticipated nonreacting antigen strength and advancing until an end point of reactivity is identified (skin endpoint titration; SET). This is a safe and effective way of performing quantitative skin testing, but it does present the disadvantage of being time consuming and somewhat labor intensive.

The concept of screening tests for allergy, whether by in vitro or in vivo methods, is well established.[2,3] In the current managed care climate, avenues are constantly being sought for more efficient methods of performing allergy testing. One such method is by in vitro techniques that use radioallergosorbent testing (RAST) or enzyme-linked immunosorbent assays.[4] Unfortunately, many third-party payers require skin testing rather than in vitro testing for the diagnosis of allergy. Because of the time and effort involved in SET, we sought to investigate other methods for use as screening tests. This study involves the Multi-Test device, which initially became available about 20 years ago, representing a modification of the Mono-Vac smallpox applicator.[5]

The Multi-Test device consists of two parallel rows of four test heads, each of which contains nine plastic points 1.9 mm in length arranged in a 2 × 2 mm square pattern. Test antigen is applied to the points by an applicator and is held to the test head by capillary action. When applied to the skin, a uniform amount is delivered to the epidermis and superficial dermis. Histamine is used as the positive control, and glycerine is used as the negative control.

Currently, the results of testing with use of the Multi-Test device are reported in a grading system ranging from 0 to 4+ on the basis of wheal and flare reaction, in much the same fashion as prick testing. However, because of the reproducibility of the amount of antigen delivered with the Multi-Test device, and the

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**Table 1.** Antigens tested

| | |
|---|---|
| Grasses | Bermuda, timothy |
| Weeds | Common ragweed, marsh elder |
| Trees | Mountain cedar, oak, elm, pecan |
| Animal dander | Cat |
| Molds | *Helminthosporium, Alternaria, Cladosporium* |
| Dust mites | *Dermatophagoides farinae, D. pteronyssinus* |

**Table 2.** Multi-Test system grading scale

| | |
|---|---|
| Negative | No wheal or wheal no larger in size than that of the negative control |
| 1+ | Wheal 1 mm larger than control |
| 2+ | Wheal 2 mm larger than control |
| 3+ | Wheal 3 mm larger than control |
| 4+ | Wheal >3 mm or pseudopodia |

**Table 3.** Comparison of negative results between Multi-Test system and RAST

| Antigen | Negative Multi-Test result* | Negative RAST result† | Agreement by antigen (%) |
|---|---|---|---|
| Bermuda | 17 | 11 | 64.7 |
| Timothy | 15 | 11 | 73.33 |
| Ragweed | 7 | 11 | 63.64 |
| Marsh elder | 10 | 14 | 71.43 |
| Mountain cedar | 14 | 16 | 87.5 |
| Oak | 15 | 17 | 88.24 |
| Elm | 18 | 17 | 94.44 |
| Pecan | 15 | 16 | 93.75 |
| Cat | 11 | 11 | 100 |
| *Helminthosporium* | 13 | 16 | 81.25 |
| *Cladosporium* | 16 | 19 | 84.21 |
| *Alternaria* | 18 | 18 | 100 |
| *D. farinae* | 12 | 15 | 80 |
| *D. pteronyssinus* | 15 | 14 | 93.33 |
| Total negative | 196 | 206 | |
| Agreement by number (%) | 95.15 | | |
| Average agreement by antigen (%) | | | 83.99 |

*Reaction ≤1+.
†Reaction ≤class I.

uniform depth to which it is introduced, this test may be more comparable to an intradermal test (which can be graded in the manner described or reported in terms of the wheal size produced).[6,7] Prior studies have shown the validity and reproducibility of test results obtained with the Multi-Test device as compared with results obtained with standard prick testing[4] and other commercial skin prick devices.[8] Nevertheless, the Multi-Test system must still be considered at best to be a semiquantitative test as compared with SET or RAST.

The correlation between SET and RAST testing has been well established.[9] Because of the ease of performing RAST testing, we chose to use an in vitro allergen-specific immunoglobulin E (IgE) assay (done with the Fadal-Nalebuff modified RAST [Serolab, Round Rock, Tex.]) as the standard of comparison in our study. We postulated that if a correlation between wheal size and the patient's degree of allergen-specific IgE could be shown, it might be possible to estimate an effective safe starting level of antigen for immunotherapy from the MultiTest system rather than from a series of intradermal tests at varying dilutions. To this end, we tested patients by use of both the Multi-Test device and RAST; the relationship between the wheal size and RAST class for each antigen was studied.

**Table 4.** Comparison of positive results between Multi-Test system and RAST

| Antigen | Positive Multi-Test result* | Positive RAST result† | Agreement by antigen (%) |
|---|---|---|---|
| Bermuda | 3 | 7 | 42.86 |
| Timothy | 5 | 7 | 71.43 |
| Ragweed | 13 | 8 | 61.54 |
| Marsh elder | 10 | 5 | 50.00 |
| Mountain cedar | 6 | 3 | 50.00 |
| Oak | 5 | 2 | 40.00 |
| Elm | 2 | 2 | 100.00 |
| Pecan | 5 | 2 | 40.00 |
| Cat | 9 | 8 | 88.88 |
| *Helminthosporium* | 7 | 3 | 42.86 |
| *Cladosporium* | 4 | 0 | 0 |
| *Alternaria* | 2 | 1 | 50.00 |
| *D. farinae* | 8 | 4 | 50.00 |
| *D. pteronyssinus* | 5 | 5 | 100.00 |
| Total positive | 84 | 57 | |
| Agreement by number (%) | 67.86 | | |
| Average agreement by antigen (%) | | | 56.26 |

*Reaction ≥2+.
†Reaction ≥class II.

## METHODS

This study was approved by the Investigational Review Board of the University of Texas Southwestern Medical Center. Twenty patients with a history and physical examination findings suggestive of inhalant allergy underwent both a Multi-Test system screen (14 antigens plus histamine and glycerine controls) and RAST testing (RAST used as a "standard"). The antigens tested were those found to be clinically relevant to the North Texas area (Table 1). Multi-Test system results were graded on a 1 to 4+ scale (Table 2). Reading of positive control results was conducted 10 minutes after administration; reading of negative controls and diagnostic extracts was done 15 to 20 minutes

after their administration. For the purposes of our analysis, positive and negative limits were arbitrarily assigned on the basis of generally accepted limits. A negative reaction from the Multi-Test system was considered to be equal to or less than 1+. A negative result from RAST was considered to be equal to or less than class I. A positive reaction from the Multi-Test system was considered to be equal to or greater than 2+. A positive result from RAST was considered to be equal to or greater than class II.

## RESULTS

The total numbers of negative results (Multi-Test ≤1+, RAST class ≤I) for the Multi-Test system and RAST were 196 and 206, respectively; overall agreement was 95.15% and average agreement by antigen was 83.99%. The total numbers of positive results (Multi-Test ≥2+, RAST class ≥II) for the Multi-Test system and RAST were 84 and 57, respectively; overall agreement was 67.86% and average agreement by antigen was 56.26% (Tables 3 and 4).

## DISCUSSION

In undertaking this study, we had hoped to demonstrate a correlation between Multi-Test system skin wheal size and RAST class. Unfortunately, this relationship was not shown. The comparison between positive results was quite variable. Instead, we found that a negative Multi-Test system result might be a useful screen in patients in whom inhalant allergy should be ruled out but is not highly likely.

We are not totally certain of the reason for the disparity in the results of the Multi-Test system and RAST that we observed. One possible explanation is that RAST measures allergen-specific IgE, whereas positive results on a skin test might involve other factors such as IgG. Also, despite careful attention to technique and the application of positive and negative controls, skin test results are subject to variability depending on the time of day, body area, exposure to antigens, and so on, and both false-positive and false-negative skin test results can occur.[10] It is well accepted that the antigens used in skin testing are not always exactly the same as the antigens used in preparing RAST discs, which might affect results to some degree. Finally, the comparison of the Multi-Test system and RAST requires an arbitrary assignment of positive and negative responses for each.

The primary value of this study is its indication of a high level of agreement of negative results. Of the 20 patients tested, 5 had a positive result to one or more antigens by the Multi-Test system, but a negative result by RAST. However, no patients had RAST-positive results to one or more antigens but negative results to the Multi-Test system for all antigens. Thus it appears that a fully negative Multi-Test system result would constitute a reliable negative screen. On the basis of the 95% agreement between negative Multi-Test system and negative RAST results, we believe that the Multi-Test system represents a valid initial screening test, especially in patients in whom (for whatever reason) in vitro testing is not an option. The test would be most appropriate for patients in whom a high index of suggestion for allergy does not exist, but for whom the clinician wishes to investigate the possibility. Because there was a less than 70% concordance between positive Multi-Test system and RAST results and agreement by antigen that averaged only slightly more than 50%, patients in whom Multi-Test system screening shows a positive result to any antigen should receive follow-up with more specific and sensitive testing methods, such as SET or RAST.

## CONCLUSION

The purpose of this study was to determine the potential correlation between allergy test results obtained with use of the Multi-Test skin testing method and the RAST blood test (used as a "standard"). Though the comparison of positive results was variable, there was a high level of agreement between negative results. In situations in which screening for allergy is desirable, and especially if a high index of suggestion for inhalant allergy does not exist, the Multi-Test device provides an efficient and cost effective means of accomplishing this evaluation.

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