

Short communication

Prick tests to aeroallergens: is it possible simply to wipe the device between tests?

Background: Improperly performed skin prick tests (SPT) can lead to wrong allergy diagnosis and incorrect treatment. To overcome false-positive results it is recommended to change the puncture device between each test, although very few studies have examined the real drawbacks (false-positives) and advantages (time and cost savings) of using only one device.

Methods: Two groups of 20 patients with rhinitis or asthma, sensitized to either house-dust mites or grass pollens, had successive serial SPT to 9% codeine phosphate and the relevant allergen using the same needle or lancet, wiped between each test.

Results: With both the needle and the lancet, there were 12.5–67.5% false-positive results using the house-dust mite or grass pollen allergen extracts, respectively. There were no false-positive results with the 9% codeine phosphate.

Conclusions: Our study shows that this technique is not reliable as it provoked an unacceptable number of false-positive results.

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Skin prick tests (SPT) represent the major tool for diagnosis of IgE-mediated diseases. Their simplicity, rapidity of performance, low cost, and high sensitivity explain their key position in allergy diagnosis. However, when improperly performed, skin tests can lead to falsely positive or negative results (1). Contamination of the needle by another allergen extract may induce false-positive results. To overcome this problem, it is recommended to change needles or puncture devices between each test. The use of a single puncture device, wiped between each test, has the advantages of a faster test procedure and a lower cost than using multiple puncture devices (1). There are, however, very few studies examining the advantages or drawbacks of using only one device (2).

This study was carried out to establish the precision of this economical way to perform SPT, using the same needle and the same lancet wiped between tests with dry cotton wool for several tests. We compared results obtained with a standardized extract of *Dermatophagoides pteronyssinus* and grass pollens. In order to explain the possible false-positive results, we measured the viscosity of the allergen extracts tested.

Material and methods

Patients and skin prick test procedure

Two groups of 20 people with rhinitis and/or asthma were studied. Patients in the first group were sensitized to house-dust mite (*D. pteronyssinus*, Der p) and those in the second to grass pollens, as demonstrated by a suggestive clinical history, positive SPT, and specific IgE (CAP System, Pharmacia-Upjohn, Uppsala, Sweden). The 20 patients sensitized to Der p (median age 30.8 years; range 15–64) consisted of 3 men and 17 women, whereas the 20 patients sensitized to grass pollens (median age 28.2 years; range 22–41) consisted of 9 men and 11 women. They had not taken any antihistamines or any drugs that might affect the performance of SPT.

Standardized glycerine/phenol-based extracts were used for *D. pteronyssinus* and the five-grass pollen mixture (*Dactylis glomerata*, *Anthoxanthum odoratum*, *Lolium perenne*, *Poa pratensis*, *Phleum pratense*; Stallergènes, Antony, France).

Arms were cleaned with cotton wool moistened with 75% ethanol. SPT were carried out 2 cm apart, and were 4 cm from elbow level and from the wrist. They were performed using a modified prick-test technique according to Pepys (1) with a Kendall 23 G needle (Kendall Company Ltd, Gosport, UK) and an Allergopharma lancet (Allergopharma, Reinbeck, Germany). We did not aim to compare the two methods.

The wheals induced by the allergen extracts and codeine phosphate 9% (positive control) and the 50% glycerol solution (negative control) were recorded 15 min after the tests using the Scotch-tape technique (1). Wheal size was measured as the mean of the longest

diameter (excluding pseudopodia) and the midpoint perpendicular diameter.

Six series of six SPT were carried out for each person, during the same visit, as shown in Table 1. They were done on the same arm and were performed by the same investigator. The first series of SPT consisted of one positive control (9% codeine phosphate solution) and five negative controls (glycerine serum). The same Kendall 23 G needle used for all six SPT and was wiped between each test with dry cotton wool.

The second series was performed using the same solutions but this time the SPT were carried out with an Allergopharma lancet that was also wiped with dry cotton wool. The following two series of six SPT were carried out in the same way, the first using a needle, the second a lancet. However, this time the first SPT of each series used a solution of allergens (Der p extract or a mixture of five grass pollens).

Finally, in the last two series of six prick tests, carried out using the same method, solutions of allergens and a negative control were used alternately in order to find a possible cumulative effect.

A false-positive reaction was defined as a wheal response at the site of the prick, with an average diameter of at least 3 mm, with the negative control solution. A false-negative reaction was defined as a wheal response at the site of the prick, with an average diameter of less than 3 mm, with the positive control or one of the allergen solutions.

Allergen extract viscosity

We then measured the viscosity of the four test solutions (9% codeine phosphate, 50% glycerol solution, Der p, and the five-grass pollen mixture). These measurements were performed at 25°C with a rotational rheometer equipped with a plate-cone sensor system (3); the geometry was a 1° cone and a 60-mm diameter plate. The sample filled the space between cone and plate. In rheometry, a torque (shear stress) is preset, and the resulting movement inside the sample is an angular velocity which can be measured. The torque (τ) required for achieving and maintaining the desired shear rate ($\dot{\gamma}$) is the viscosity-proportional parameter. The viscosity (η) is calculated in accordance with the newtonian conditional equation:

$$\eta = \tau / \dot{\gamma}.$$

Statistical methods

Correlations were analyzed by the Spearman's rank correlation coefficient test.

Table 1. Six series of six SPT were performed for each person during the same visit, according to the scheme below

	Series 1 and 2		Series 3 and 4		Series 5 and 6	
	Needle	Lancet	Needle	Lancet	Needle	Lancet
1	PC	PC	A	A	A	A
2	NC	NC	NC	NC	NC	NC
3	NC	NC	NC	NC	A	A
4	NC	NC	NC	NC	NC	NC
5	NC	NC	NC	NC	A	A
6	NC	NC	NC	NC	NC	NC

PC: positive control (9% codeine phosphate); NC: negative control (50% glycerol solution); A: allergen standardized extract of Der p or grass pollen.

Results

In the whole group of 40 patients, we observed no false-positive and no false-negative results with the control test solution (9% codeine phosphate). This was the case for both the needle and lancet methods (Table 2).

For the Der p extract, when using the Kendall needle wiped out with dry cotton wool, 12.5% (5/40) of the tests carried out with the negative control were falsely positive (Table 2); using the Allergopharma lancet, 12.5% (5/40) false-positive tests were observed.

For the mixed grass pollen extract, 67.5% (27/40) of the tests carried out with the negative control were falsely positive (Table 2); using the Allergopharma lancet, 50% (20/40) false-positive tests were observed.

There was no correlation (Spearman's rank test) between the size of the allergen skin test and the size of the next false-positive test.

No cumulative effect was shown, either with the techniques, or with the allergen extracts.

Measurement of the viscosity of the solutions showed significant differences. The highest viscosity of $\eta = 8.02$ mPa/s was observed for the positive control (9% codeine phosphate), followed by the Der p allergen extract ($\eta = 7.532$), the negative control (50% glycerine solution; $\eta = 7.289$), then the mixed-grass pollen extract ($\eta = 6.399$).

Discussion

This study shows that using the same needle or lancet for performing several SPT induces false-positive results. Therefore, although this method may be attractive because it decreases the time and costs of testing, it cannot be used. Kupczyk et al. (2) also recently showed

Table 2. False-positive and false-negative results of multiple skin prick testing with the same needle or lancet in 20 patients sensitized to house-dust mite and 20 patients sensitized grass pollens

	Kendall 23 G needle	Allergopharma lancet	Viscosity mPa/s
Positive control*			
Mean diameter†	4.7 ± 0.6 mm	5.0 ± 0.4 mm	8.02
False-positive‡	0% (0/40)	0% (0/40)	
False-negative‡	0% (0/40)	0% (0/40)	
Der p allergen extract			
Mean diameter†	4.8 ± 0.7 mm	4.6 ± 0.4 mm	7.532
False-positive‡	12.5% (5/40)	12.5% (5/40)	
False-negative‡	5% (2/40)	17.5% (7/40)	
Grass pollen extract			
Mean diameter†	6.3 ± 0.9 mm	5.2 ± 0.5 mm	6.399
False-positive‡	67.5% (27/40)	50% (20/40)	
False-negative‡	0% (0/40)	5% (2/40)	

* 9% codeine phosphate.

† Mean ± standard deviation.

‡ A total of 40 because $n = 20 \times 2$ series per subject.

13/35 false-positive results in tests using a single Allergopharma lancet (cleaned with cotton moistened with 75% ethanol) for multiple skin pricks with allergen extracts, but not with positive histamine and codeine controls.

We were surprised to note that when using the same technique the number of false-positive results varied significantly from one solution to the other. We therefore examined the differences in physicochemical properties of each test solution. Differences in the viscosity of these test solutions were observed and may explain different degrees of allergen retention in the interior of the needle, or along

the sides of the lancet. The high relative viscosity of the codeine phosphate solution is closely related to the total absence of false-positive results after the prick with the needle or the lancet using this solution. The lower viscosity of grass-pollen extract correlates with the highest level of false-positive results. However, these differences in viscosity may not be the only reason; other parameters could be investigated more broadly. Further studies are needed to confirm that the increase in viscosity of allergen solution (e.g. by adding more glycerine) cancels false-positive results.

References

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