

# Bevel-down superior to bevel-up in intradermal skin testing

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**Background:** Intradermal skin testing is one of the most widely used procedures in the diagnosis of hypersensitivity diseases, *in vivo*. It is critical to perform the test accurately and expediently. Yet, there are few articles describing its detailed technique or proficiency available.

**Objectives:** To identify the better method for intradermal testing between the bevel-up and bevel-down techniques.

**Methods:** Three inexperienced testers performed intradermal injections using both methods. Four sets of paired trials each consisting of ten injections were applied randomly, alternating between the same volunteer subject's contralateral arms. Duration to complete ten injections was measured. Numbers of injection sites that bled, that squirted into the air, and failed to form a bleb were counted. The overall comfort level was determined.

**Results:** The times to complete the injections by bevel-up and by bevel-down methods were  $165.5 \pm 31.3$  and  $152.5 \pm 27.4$  seconds, respectively ( $P < .015$ ). The number of injection sites that bled was higher in the bevel-up method, particularly on trial one ( $P < .001$ ). Completion rate of successful bleb formation in bevel-down was 27.3 as compared with 23.3 in bevel-up method ( $P = .013$ ). The comfort level was higher with the bevel-down than the bevel-up method ( $P = .0001$ ).

**Conclusion:** The bevel-down method of intradermal testing is superior to the bevel-up method.

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## INTRODUCTION

The intradermal or intracutaneous skin test is one of the most widely used diagnostic procedures in hypersensitivity diseases, *in vivo*. The procedure requires delicate skill as a small amount of solution is injected into a very superficial layer of dermis to make a small bleb, 2 to 3 mm in diameter. It is difficult to inject antigen into a thin layer of upper dermis (thickness varies between 0.5 to 1.5 mm)<sup>1</sup> without squirting into the air or injecting too

deeply into a loose tissue layer of dermis or subcutaneous tissue. The procedure requires accuracy and proficiency of testers particularly when many tests are done such as in skin testing in allergy practice. A detailed description of the actual injection is not clearly described<sup>2-4</sup> or contradictory in textbooks.<sup>5-8</sup> There are two methods of intradermal skin testing: one, the bevel-up method, in which allergen is gently injected into the upper dermis of the skin with the opening of the needle facing away from the skin surface<sup>5,6</sup>; and the other, bevel-down method, in which the opening of the needle faces down toward the skin at the point of contact.<sup>7,8</sup> The former is more frequently used as nurses are taught the bevel-up method.<sup>6</sup> Conventional allergy textbooks often do not describe needle entry point clearly. Further, there have been no comparative data on the efficacy of the two basic methods.

The authors, therefore, attempted to identify the better of the two methods for performing intradermal skin tests. Proficiency in performance of the testers and comfort level of the subjects were also determined.

## METHODS AND MATERIALS

With the approval of the Institutional Review Board, we recruited three second-year medical students as testers; these recruits had no previous experience in any skin testing procedures. This step was to ensure that the experiment was not influenced by a tester's previous experience in one way or the other. Bevel-up and bevel-down methods were explained and demonstrated. Testers were then allowed to practice four times before proceeding to the actual testing.

Three volunteers were recruited and informed consent was obtained. The skin of both upper arms of each subject was cleaned with an alcohol swab and ten points in a row were marked on the surface of each arm longitudinally with a gentian violet felt-tip pen. Testers used pre-loaded syringes for intradermal test use, 27 g x  $\frac{3}{8}$  inch (Terumo Medical Co., Elkton, MD), filled with sterile saline (control diluent, Hollister-Stier, Spokane, WA), and injected 0.03 mL of the solution intradermally at the marked sites. Each volunteer subject received at least a set of ten injections in one arm and in the contralateral side of the other arm by either bevel-up or bevel-down method (Fig 1). One subject received two sets of tests. Each row was injected entirely using either the bevel-up or bevel-down method randomly in an alternating fashion. A total of four sets of ten intradermal tests were performed using both methods. An observer used a stopwatch to record the time required to complete a row from start to finish.

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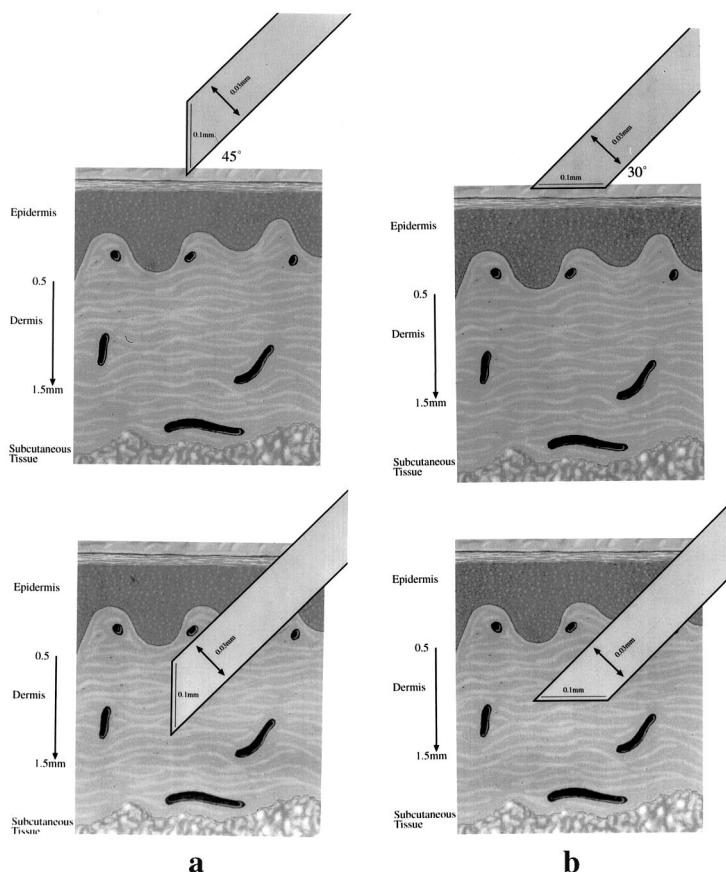


Figure 1. Schematic illustration of the bevel-up (a) and bevel-down (b) methods of intradermal injections.

Four variables were compared between the two methods: (1) total time required to perform each row of ten injections, (2) number of sites that bled, (3) number of sites where the

solution was squirted into the air, and (4) number of sites at which the solution was injected into the subcutaneous tissue (no bleb) instead of being placed at the desired level.

The level of discomfort reported by the subjects was recorded. In addition, we calculated learning ability of the testers from trial 1 to trial 4.

## STATISTICAL ANALYSIS

Mean  $\pm$  SD was calculated and paired Student's *t* test was used with significance at 0.05. One way analysis of variance using the general linear model was used to determine the learning effect. Computations were done by procedures in the SAS system.

## RESULTS

Table 1 summarizes the comparative results of intradermal testing done using both methods. The success rate, as defined as completion of a bleb without bleeding or squirting, with the bevel-up method was  $23.3 \pm 1.97$  out of 30 trials (77.7%) while that of bevel-down was  $27.3 \pm 1.44$  out of 30 trials (91.0%) ( $P < .013$ ). Time required for ten intradermal injections was  $165.5 \pm 31.3$  seconds for bevel-up and  $152.5 \pm 27.4$  seconds for bevel-down ( $P = .015$ ). The bevel-up method had a significantly higher mean frequency of bleeding (6.33%) compared with the bevel-down method (2.33%) on trial one ( $F = 7.06$ ,  $P = .001$ ) based on 3 and 6 degrees of freedom. The discomfort level of the subjects was significantly lower with the bevel-down method (25%) than with the bevel-up (50%,  $P = .0001$ ).

Table 1. Variables During Four Trials by Bevel-Up and Bevel-Down Methods

| Tester      | #1  |      | #2  |      | #3  |      | #4  |      |
|-------------|-----|------|-----|------|-----|------|-----|------|
|             | UP  | DOWN | UP  | DOWN | UP  | DOWN | UP  | DOWN |
| 1 Time, sec | 217 | 184  | 161 | 120  | 174 | 145  | 160 | 154  |
| Squirts     | 0   | 1    | 0   | 0    | 0   | 0    | 1   | 0    |
| Bleed       | 6   | 2    | 3   | 3    | 2   | 2    | 2   | 3    |
| No bleb     | 0   | 1    | 0   | 0    | 0   | 0    | 0   | 0    |
| 2 Time, sec | 152 | 142  | 143 | 130  | 143 | 140  | 129 | 126  |
| Squirts     | 0   | 0    | 0   | 0    | 0   | 0    | 1   | 1    |
| Bleed       | 8   | 4    | 2   | 3    | 2   | 0    | 3   | 1    |
| No bleb     | 0   | 0    | 0   | 0    | 0   | 0    | 0   | 0    |
| 3 Time, sec | 236 | 213  | 171 | 177  | 150 | 139  | 150 | 160  |
| Squirts     | 1   | 1    | 1   | 2    | 1   | 0    | 1   | 1    |
| Bleed       | 5   | 1    | 2   | 1    | 1   | 1    | 2   | 0    |
| No bleb     | 0   | 0    | 0   | 0    | 0   | 0    | 0   | 0    |

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## COMMENTS

This brief study conclusively shows that the bevel-down method is superior to the bevel-up technique for injecting small quantities of solutions into intracutaneous sites. Intradermal testing by the bevel-down approach takes less time and has a higher success rate than the bevel-up method. In addition, the bevel-down method results in fewer instances of the solution being squirted into the air. For allergy skin testing squirting the allergen into the air can cause testing failure but also can cause an allergic reaction in the testing technician if allergic to the antigen. The bevel-down method also causes bleeding less frequently and leads to fewer test failures. These findings are logical considering that the bevel-down method requires a shallower needle depth embedded in the dermis than does the bevel-up method (Figure 1).

More importantly, however, the reduced time required for testing will permit more comparable intervals before reading, allowing a comparable time for the immediate "wheal and flare" reactions to mature before the results are read. The results indicate that the bevel-down method requires 10% less time to perform ten injections, and yields a 15% improvement

in the overall success rate as compared with the bevel-up method.

The subjects who received tests reported that they felt less pain with the bevel-down than by the bevel-up method. Learning ability, however, was better with the bevel-up method as compared with the bevel-down method. Overall, the authors recommend use of the bevel-down method for intradermal skin testing.

## CONCLUSION

The bevel-down method of intradermal skin testing is superior to the bevel-up method, requiring less time while providing a higher success rate.

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