

POINT-OF-CARE MULTI-PARAMETER TYPING OF 10 BLOOD GROUPS WITH STABLE END-POINT*

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Background: Current rapid tests for blood typing do not have stable end-points. Sophisticated techniques, which provide more objective and stable results, are rather slow and need a centrifugation step [1, 2]. All these methods have in common that only one parameter at once can be determined.

The purpose of this study was to develop a blood grouping format on the basis of known lateral flow assays [3] with multi-parameter testing in a single assay and stable end-point, but without centrifugation, suited both for a laboratory environment and for point of care situations.

Methods: A credit-card sized lateral flow test device was constructed with a membrane equipped in a cassette housing. The device has a central application zone and 2 equidistant detection areas printed with parallel lines of antibody reagents.

Further, both detection areas contain a flow validation spot (val) and an auto control spot (ctl).

Two card configurations have been designed, one suited for typing of recipients, whereas the second is rather suited for donor typing recognizing the partial D category VI:

- 1) **A-B-D^(VI+)-D^(VI-)-K--C-C^w-c-E-e.**
- 2) **A-B-D^(VI+)-D^(VI-)-K--C-C^w-c-E-e.**

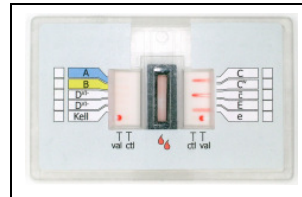


Figure 1a

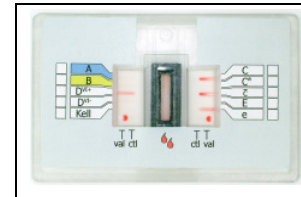


Figure 1b

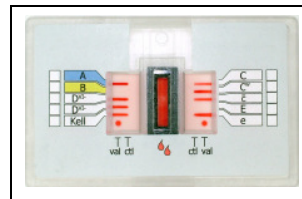


Figure 2

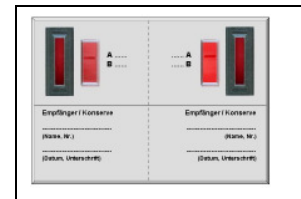


Figure 3

Figure 1: Lateral flow blood grouping devices run with a **DVI Red Cell Reagent** (Diagnostics Scotland). **a)** Card configuration A-B-D^(VI+)-D^(VI-)-K--C-C^w-c-E-e Result: Blood group O Ccddee kk. **b)** Card configuration A-B-D^(VI+)-D^(VI-)-K--C-C^w-c-E-e. Result: Blood group O CcD(VI)ee kk. **Figure 2: Donor blood:** A CC^wcD.ee K. Note the difference in the concentration, composition and therefore appearance of bands between a red cell reagent (fig. 1) and a diluted whole blood (fig. 2).

Figure 3: Card design for bedside testing (modified and simplified procedure): Recipient (left) and segment (right) are blood group A.

Test procedure:

1. **Mix 50 µl of anticoagulated blood with 200 µl of diluent.**
2. **Pipette 100 µl of the resulting suspension into the application zone of the device.**
3. **Add 300 µl of diluent to the application zone.**
4. **Read and record results after 5 minutes.** Positives are recognized as distinct red bands, negatives by the absence of the respective band. The result is valid, when the val is positive (red spot) and the ctl is negative (no signal).

Results: Bloods of about 2400 blood donors, previously typed for the respective blood groups with the Olympus PK-80, have been tested with the **A-B-D^(VI+)-D^(VI-)-K--C-C^w-c-E-e** card. The results for all antigens were in agreement with those of PK-80. Results were stable for at least 4 weeks after testing. Typical results are illustrated in the figures.

Conclusions: A simple, rapid and flexible method for blood typing with a stable and for the naked eye visible end-point is presented, allowing for:

1. **Miniaturization:** less reagent consumption, less waste
2. **Simplification:** 2 pipetting steps for 10 parameters, no centrifugation
3. **Application in a point-of-care environment, e. g.:**
 - Military context
 - Decentral collection sites for blood donations
 - ABO-Identity test at the patient bedside.

References:

- [1] Sinor LT, Rachel JM, Beck ML, Bayer WL, Coenen WM, Plapp FV: Solid-phase ABO grouping and Rh typing. *Transfusion* 1985; 25, 21-23.
- [2] Lapiere Y, Rigal D, Adam J, Josef, D, Meyer F, Greber S, Drot C. The gel Test : a new way to detect red cell antigen-antibody reactions. *Transfusion* 1990; 30: 109-113.
- [3] Zuk RF, Ginsberg VK, Houts T, Rabbie J, Merrick H, Ullman EF, Fischer MM, Sizto CC, Stiso SN, Litman DJ: Enzyme immunochromatography - a quantitative immunoassay requiring no instrumentation. *Clinical Chemistry* 1985; 31, 1144-1150.

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