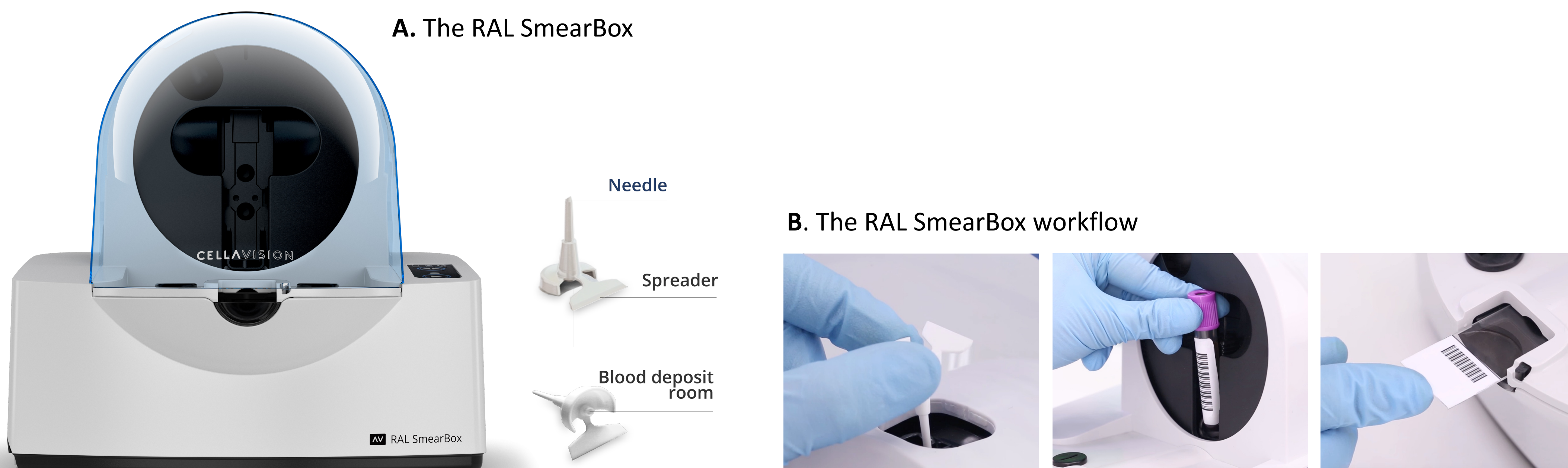


Introduction and objective

The RAL SmearBox (CellaVision) is a standalone device that performs blood smears semi-automatically. The aim is to obtain standardized spreads, suitable for automated digital morphology and manual microscopy. The objective of this work is to evaluate the quality and efficiency of the spreader and to compare it to a connected automated slide preparation system device used routinely, the SP-50 (Sysmex).

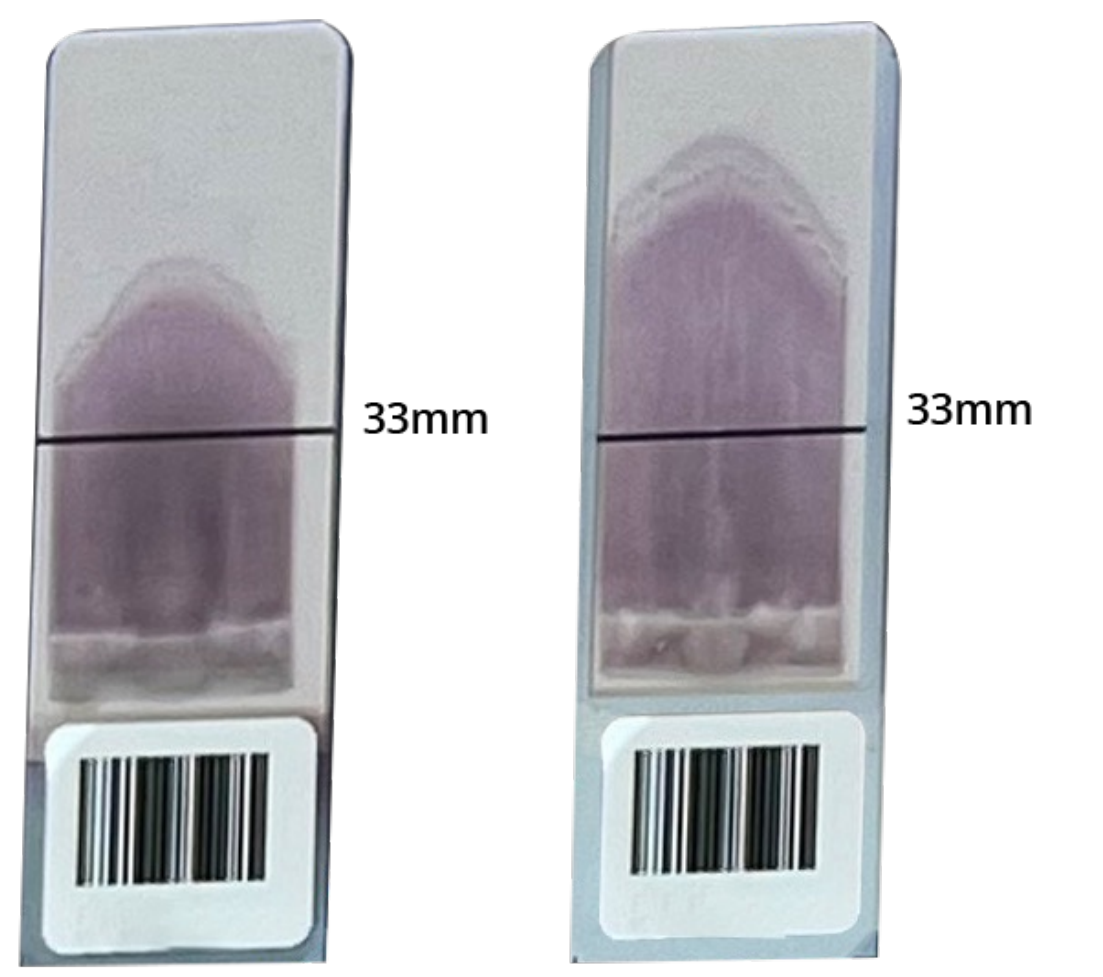
Materials and Methods

The RAL SmearBox [A] is a standalone compact device (H 23.3cm, W 23.5cm, D 23.8cm, weight 2.2kg). Smears are made from a closed whole blood sample, collected in 5 mL EDTA-K2 tubes, that are pierced with a RAL SmearBox slide spreader. This consumable fulfils 3 functions : piercing the blood tube, depositing a drop of blood, and spreading it making it a more economical and ecological choice. The study compares blood smears made by the two different methods - one spread by the RAL SmearBox [B] (1 slide in 1 minute and 30 seconds) and the other by the SP-50 (1 slide in 45 seconds to 1 minute 5 seconds). 104 patients were selected : 48 patients with haematologic diseases (21 patients with lymphoma, 23 with acute leukaemia, 1 with congenital sideroblastic anemia, 3 myeloproliferative neoplasms), 16 patients with red blood cell disease (spherocytosis, elliptocytosis, drepanocytosis, thalassaemia), 3 patients with mononucleosis syndrome, 2 patients with Ewing's sarcoma, 3 patients with lysosomal storage disease and 32 patients without haematological disease or cytological abnormality. The 208 blood smears were examined using a conventional manual microscope by 2 experts.



Results

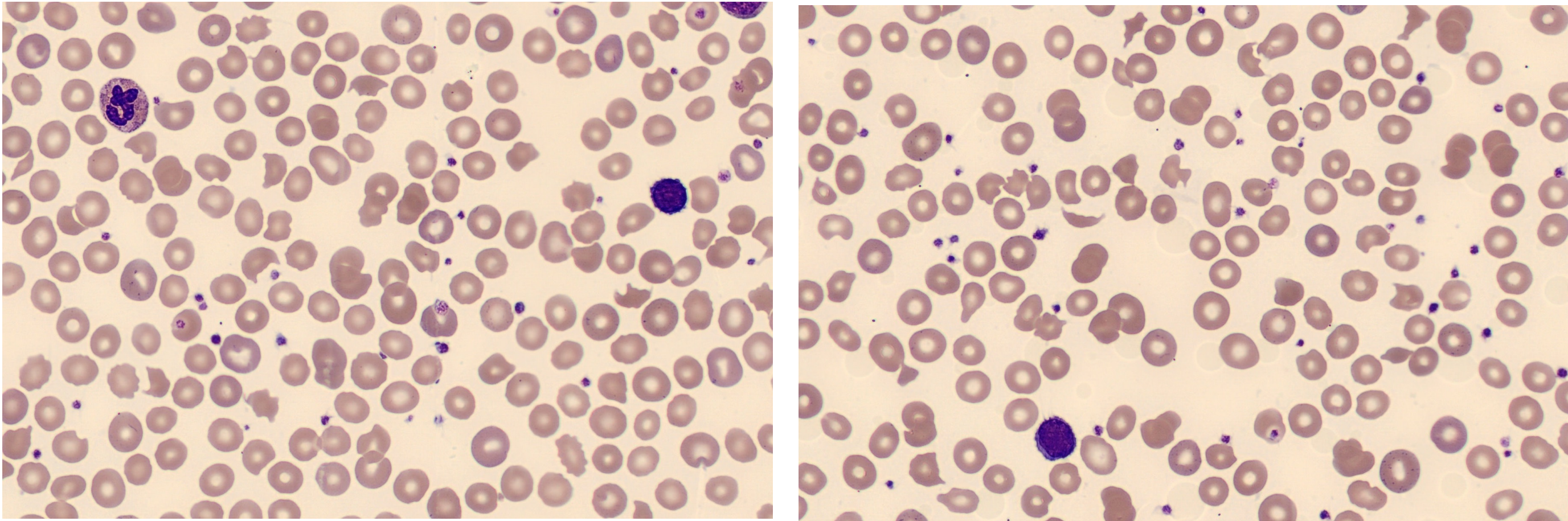
The blood smears were evaluated according to macroscopic criteria: length, width, shape, symmetry, reading area; and to microscopic criteria: cell distribution, reading area, cell morphology at x10 and x50 magnification. Two different types of smears are available [C]: the short one [*on the left*] and the standard one [*on the right*]. Macroscopically, the SP-50 spreaded 1 patient/104 (<1%) poorly and the RAL SmearBox spreaded 5/104 (4.8%) poorly [D *on the left*]. Microscopically, the viewing area was poor for 1 patient/104 (<1%) on the SP-50 and for 2 patients/104 (1.9%) on the RAL SmearBox. However, for each patient, it was possible to perform all leucocyte counts and to analyze morphological abnormalities, with no significant difference observed between the two smear preparation techniques. The morphology of all red blood cells, platelets and white blood cells showed no significant differences or lack of identification between the two techniques. The presence of fragmented red blood cells, of blastic cells, and lymphoma cells were not significantly different [E,F,G]. The presence of rouleaux of red blood cells was noted for 23 patients/104 (22.1%) spread via the RAL SmearBox. Indeed, some red blood cells clusters were observed [H] with no impact on the microscopic diagnosis [I]. On 4/104 patients (3,8%), red blood cells were altered, and it was more difficult to accurately assess the presence of red blood cell disease [J].



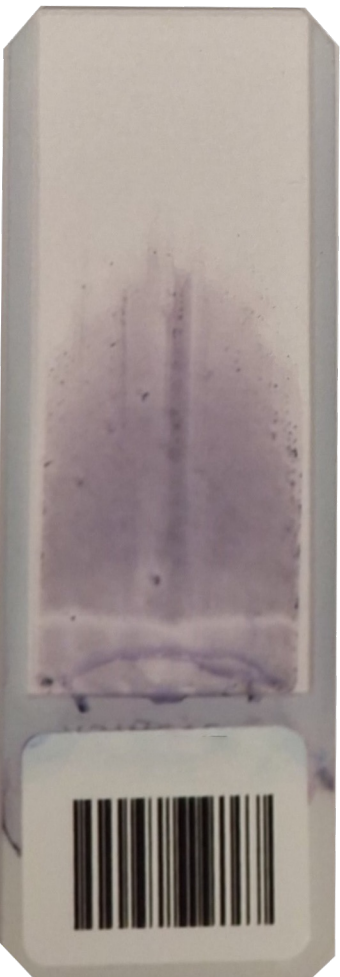
C. Two types of smears : short (on the left) and standard (on the right)



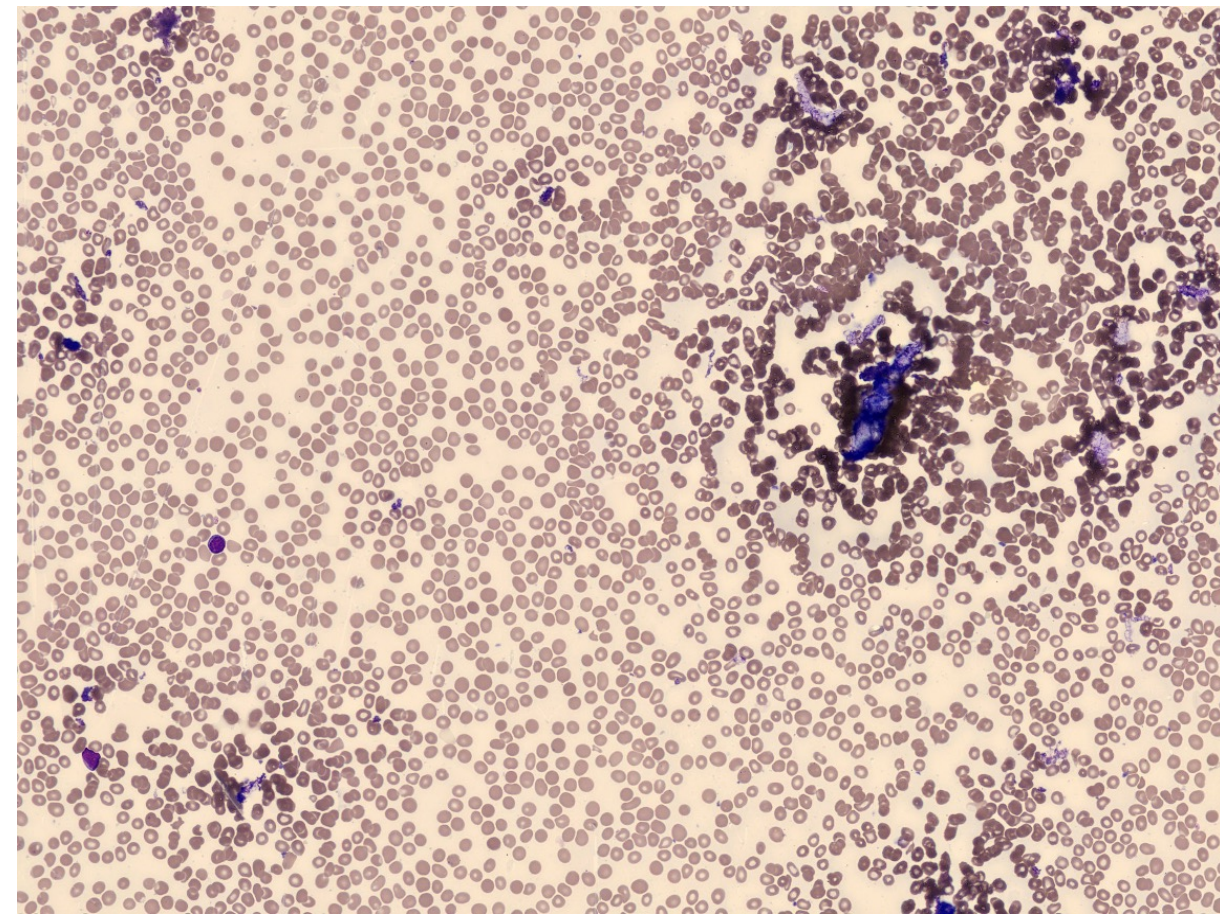
D. Macroscopic blood smears spreaded by the RAL SmearBox



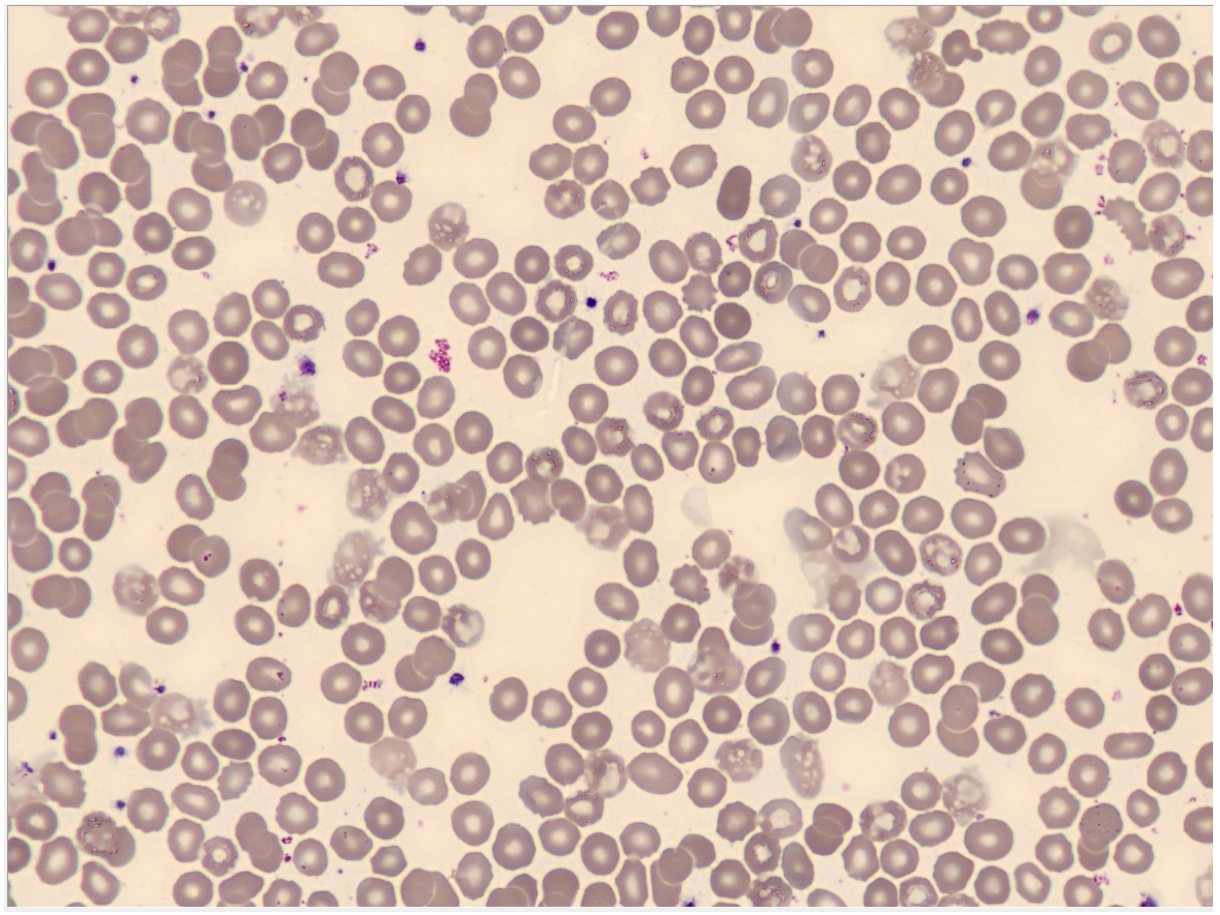
E. Fragmented red blood cells with both techniques : SP-50 on the left and RAL SmearBox on the right (DC-1)



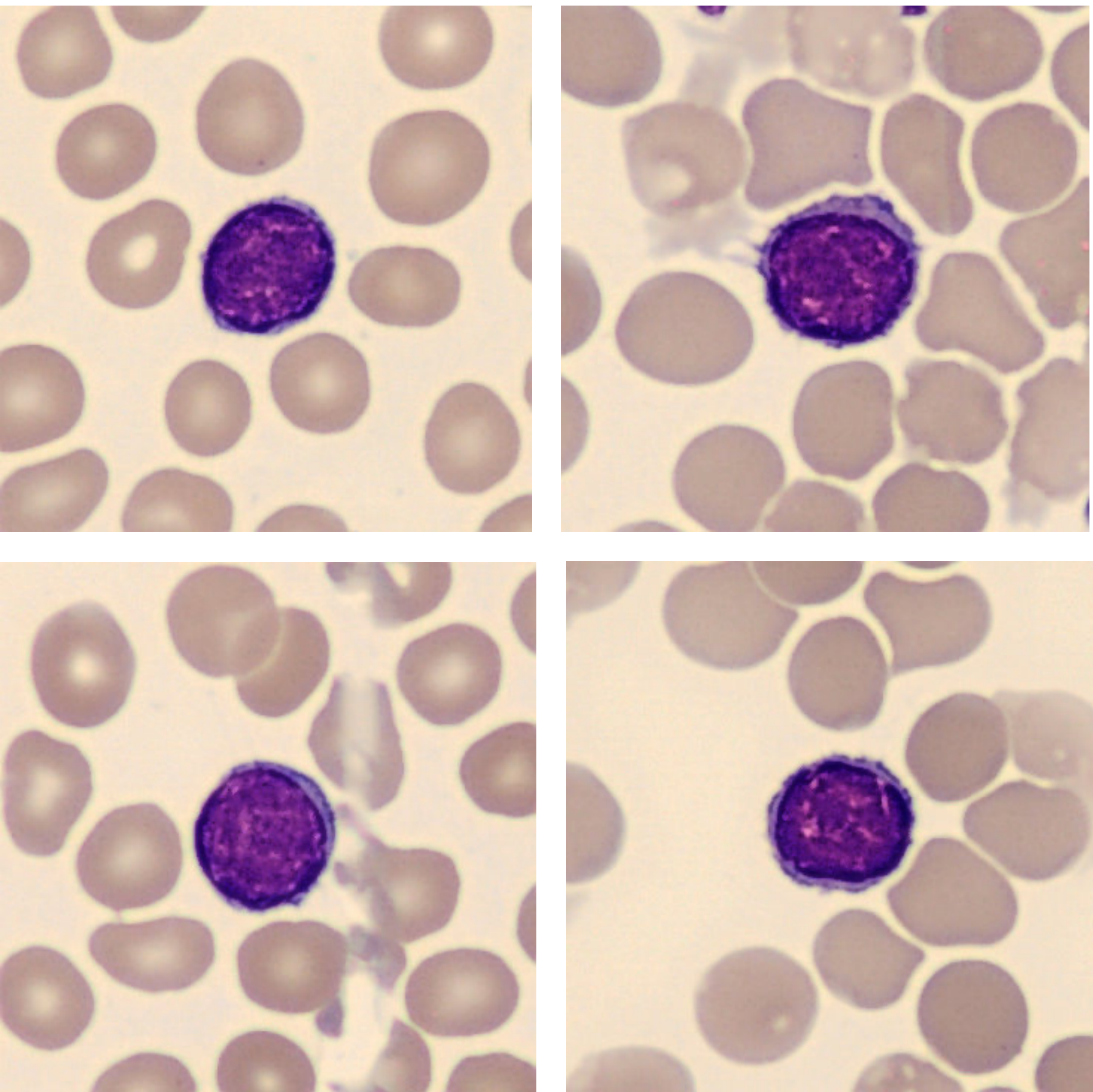
H. Clusters of red blood cells, macroscopic view



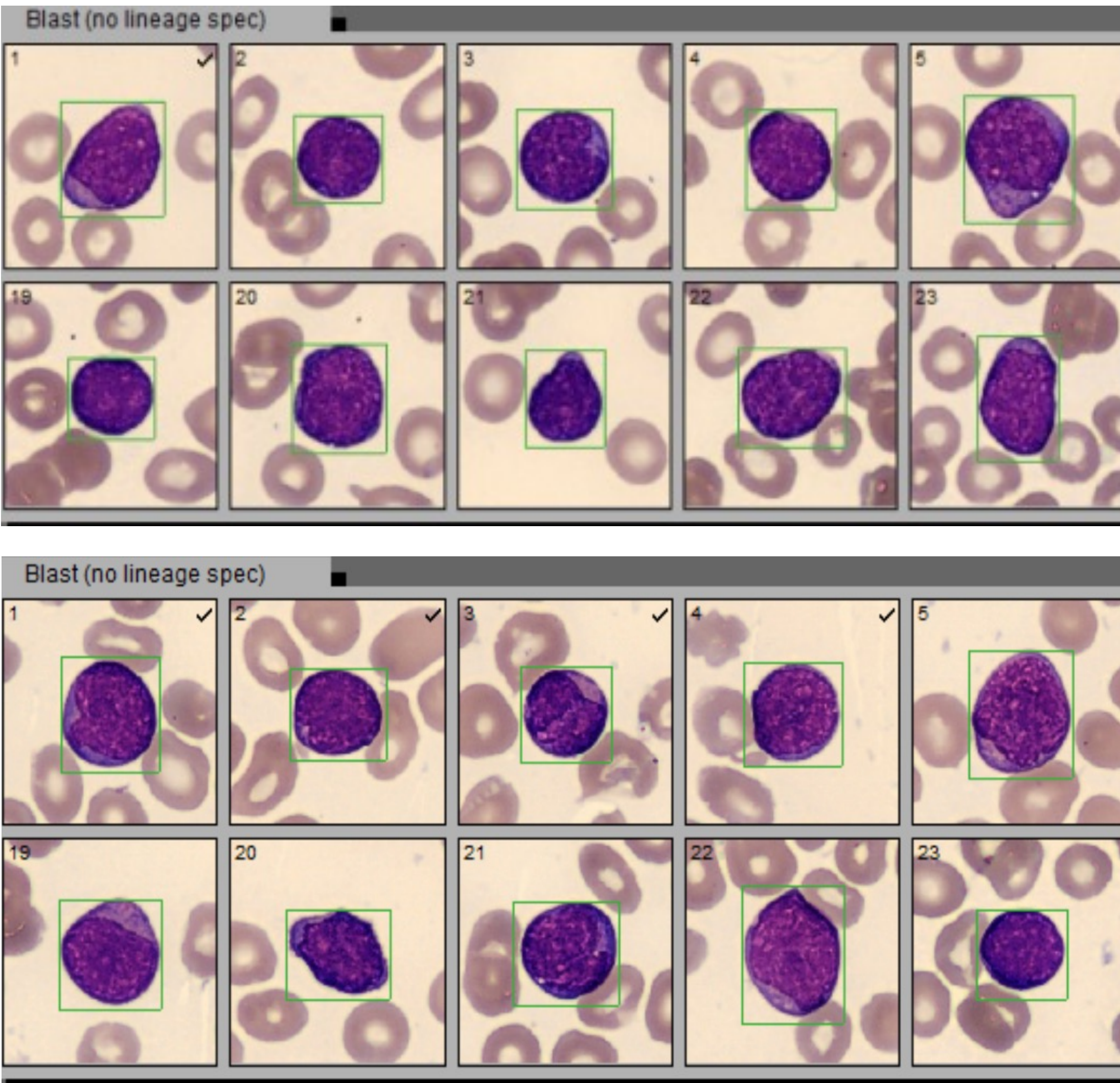
I. Clusters of red blood cells, microscopic view (DC-1)



J. Picture of a smear with altered red blood cells (DC-1)



G. Pictures of lymphoma cells (CLL) with both techniques : SP-50 on the left and RAL SmearBox on the right (DC-1)



F. Pictures of blastic cells with both techniques : SP-50 on the top and RAL SmearBox on the bottom (DC-1)

Conclusion

RAL SmearBox is a compact machine, which standardizes and produces high quality blood smears. Irregular spreading of red blood cells is sometimes observed; this has no impact on the ability to make a cytological diagnosis or clinically impact patient management. The spreading of RAL SmearBox and SP-50 are comparable macroscopically and microscopically. In large laboratories the RAL SmearBox can be used as a back-up. It is also suitable for smaller laboratories that would like an automated, standardized smear process, but do not require a connected automated slide preparation system. The goal of the RAL SmearBox is to replace the often irregular manual spreading for a standardized smear. This solution offers reproducibility, safety, workflow improvement and quality.