Evaluation of a Novel Serology-Based Platform for Simultaneous Blood Group Antibody Identification and Antigen Typing (Project MosaiQ™)

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Background
MosaIQ™ is a new serology-based antibody-antigen microarray technology in development which has the capability to simultaneously combine blood group antigen typing, direct antiglobulin testing, reverse typing, irregular antibody screening and identification, in one step. Currently, automated systems run ABO/RhD typing (some run Rh/K also) and an initial antibody screening test. If the antibody screen is positive, an antibody identification investigation will subsequently be performed, often manually, before suitable blood can be selected for cross-matching. If required (e.g. first time donor) additional confirmatory or extended blood typing may also be performed. Identifying the antibody and performing extended antigen typing in the initial test would offer time and cost savings in the provision of blood for patients.

Aim: The technology has been developed to meet the sensitivity levels required for donor and patient testing, and of current state-of-the-art systems. This work reports an evaluation of the technology to perform blood group antigen typing and irregular blood group antibody identification on over 1000 samples.

Antibody Identification – Method & Results
Quotient 10 cell panel reagent red blood cells, suspended in a proprietary print buffer, were printed onto a slide to yield stable cell monolayers.

Figure 3: Sample images when samples of Anti-O, Anti-Eα, Anti-e and Anti-K were tested using the MosaIQ™ system against a printed 10 cell panel and detected with an anti-human IgG and IgM cocktail of secondary antibodies.

1000 Random Donor (EDTA) Plasma Sample Study
99.9% Correlation to Comparator Achieved (Table 1)

Table 1: 1000 samples were tested on MosaIQ™ and with comparator systems. Seven positives were identified initially on the comparator system. After retest four of them were confirmed to be positives, of which MosaIQ™ detected three of these (3 out of 4). Of the negatives, 99.96% (996/1000) by MosaIQ™ and 99% (987/1000) by comparator. Correlation with comparator was 99%

Antigen Typing – Method & Results
Formulated antibodies to blood group antigens A, B, C, D, E, K, and buffer were printed in arrays onto a modified substrate for this feasibility study. The 16 arrays per slide were subdivided into wells using a super-structure.

Figure 5: Schematic representation of the MosaIQ™ antigen typing assay.

Representative results for MosaIQ™ antigen typing
No. of Positives No. of MosaIQ™

Evaluation of 1022 random donor (EDTA) samples
To evaluate the feasibility of the MosaIQ™ antigen typing platform 1022 random samples were tested and results compared with those obtained from comparator (CAT) testing carried out in parallel. The results correlated with a confidence of 98% or greater for the detection of A, B, C, D and E antigens. Correlation for K detection was 68%.

Demonstration of specificity detection of A. cells
An antibody known to detect A. cells (as component of a blended anti-A,B reagent) was printed in the microarray and shown to bind red blood cells from A donors equally as well as red cells from A and AB donors.

Conclusions
The study demonstrated that MosaIQ™ can be used for irregular blood group antibody identification and extended antigen typing simultaneously. The platform showed the required level of sensitivity against weak blood group antibodies and antigens, while demonstrating no unwanted positives. Development and optimisation work is ongoing to extend the range of blood typing specificities available on MosaIQ™. Adaptations of this format have also successfully demonstrated that direct antiglobulin testing, reverse ABO typing and serology assays can also be performed in parallel. The MosaIQ™ platform offers an efficient testing system which challenges current serology and molecular systems.