Ortho Clinical Diagnostics

Because Every Test Is A Life™

Scientific Evidence

ID-Micro Typing System™ (ID-MTS™) Gel Test for the Transfusion Medicine Lab

July 2021

The information presented in this document is intended for health care professionals.
Patients should consult a health care professional regarding specific medical conditions and treatments.

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Why This Book

With increasing compliance requirements and resource challenges around the world, there is a growing need for labs to reduce errors, decrease the need for double-checks and signoffs, and improve process efficiency. It is becoming increasingly apparent that the integration of digital platforms presents one of the best solutions to overcoming these challenges.

Labs Today Are Facing Major Pressures

- **Aging Population Is on the Rise:** The aging population is skyrocketing, driving increased testing volume and complex conditions.
- **Growing Test and Volume Complexity:** High variability drives the need for enhanced data management and the establishment of uniform rules.
- **Increased IT Complexity:** These ever-changing environments drive the need to automate results and consolidate them in an easily accessible, central location.
- **Increasing Regulatory Requirements:** Increasing regulatory guidance drives the need to automate the audit process (reflex testing, crosscheck to previous results, QC validation and so on).
- **Labor Shortages:** With less staff, there is a growing need for integration of digital platforms to reduce errors and provide greater process efficiency.
- **Need for Interconnected and Individual Systems:** In addition to individual instruments and processes, scalable, interconnected systems provide a way to meet the changing landscape.

In this educational booklet, you will find a compilation of some key scientific publications for the ORTHO VISION® Analyzer, ORTHO VISION® Max Analyzer and the fully automated menu including titrations and extended antigen typing. This data has been referenced in public domain journals as well as in educational forums and platforms. The main objective is to provide insightful proof points for key benefits such as:

- **Proven Performance:** Average turnaround time (TAT) under 23 minutes, 95% of tests completed in 39 minutes or less
- **Increased Efficiency:** Automate up to 99% of your testing needs
- **Trusted Results:** 99.9% concordance between automated and semi-automated platforms
- **Trusted Reliability:** Uptime you can rely on with dedicated partnership and support

The publications summarized in this booklet use these key attributes in their analysis:

	DEFINITION	EXAMPLES
R Reliability	Ready to go and simple to use when every minute counts	Increased uptime and less service time Better staff time management
E Efficiency	Delivers consistent, predictable performance and allows the optimization of resources	Automation without compromising TAT Less manual testing Better use of skilled staff Consistent and predictable TAT
C Confidence	Integrates advanced security software for trusted results	Superior intelligence to ensure secure patient data Continual quality monitoring Standardization and consistency

Ortho is dedicated to helping hospitals overcome the barriers to delivering safe, timely transfusions by arming laboratorians with the tools and knowledge to better control their complex operations. An integrated solution of high-quality assays, cutting-edge automated processing and advanced workflow tools supported by best-in-class service and support make it possible for labs to optimize valuable resources and trust in their results. Because Every Test Is A Life™

Key Conclusions

Increased uptime:

- Labs with E-CONNECTIVITY® Technology experience 24% fewer service calls

Time savings:

- Valuable minutes saved with increased system availability
- A 30% faster boot-up time and 60% faster antivirus scanning*
- Improved usability
- Ease of use

Fully automated:

- Over 99% of the daily workload without compromising throughput (TPT)/turnaround time (TAT)
- Elimination of manual testing and increased staff efficiency
- Over 95% of tests are automatically graded, interpreted and accepted
- Everything required to run tests is on-board and available
- Consistent TAT of 97% of results in under 40 minutes

Safe and secure patient data:

- Cybersecurity
- Antivirus
- Quality safety checks with INTELLICHECK® Technology
- Standardized platform
- Consistency across networks

*Data for the ORTHO VISION® Swift Platform – for availability contact your Area Representative

Glossary of Key Terms

ABO Discrepancies

A discrepancy exists when the results of red cell tests do not agree with those of serum tests, usually due to unexpected negative or positive results in either the forward or reserve typing. ABO discrepancies may arise from intrinsic problems with either red cells or serum or from technical errors in performing the test.

Acquired B Phenotype

The acquired B phenotype phenomenon is a transient serologic discrepancy in group A individuals that causes red cell grouping discrepancies. Acquired B should be suspected when a patient or donor who has historically typed as group A now presents with weak B expression on forward red cell typing. Serologically, the acquired B phenotype shows strong agglutination with anti-A typically shows weak agglutination (2+ or less) with certain monoclonal and most polyclonal anti-B and contains a strong anti-B in serum. Despite reactivity of the patient's red cells with anti-B, the patient's serum is not reactive with autologous red cells. Acquired B is the result of deacetylation of the A antigen's N-acetylgalactosamine, yielding a B-like galactosamine sugar. In patient's samples, acquired B is often present in the setting of infection by gastrointestinal bacteria. Many enteric bacteria possess a deacetylase enzyme capable of converting A antigen to a B-like analog.

C/c and E/e Antigens

The RHCE alleles encode the principal C/c and E/e antigens. More than 150 different RHCE alleles are known, and many are associated with altered or weak expression of the principal antigens and, in some cases, loss of high-prevalence antigens. Among the clinical considerations, it has long been recognized that alloimmunization represents a significant problem in patients with Sickle Cell Disease (SCD) because 25% to 30% or more of those who are chronic transfusion recipients develop red cell antibodies in the absence of minor blood group-antigen matching. To address the problem, many treatment programs determine the pretransfusion red cell phenotype in patients with SCD and transfuse red blood cells (RBCs) that are C- and E-antigen matched. Antigen matching reduces alloimmunizations significantly.

Dosage and Zygosity

The reaction strength of some antibodies may vary because of dosage, meaning that antibodies are more strongly reactive (or only reactive) with red cells that pose a "double-dose" expression of the antigen. Dosage describes the expression of an antigen on red cells, while zygosity describes the degree of similarity of alleles (alternative forms of the same gene) present at a given locus. Double-dose antigen expression occurs when an individual is homozygous for the gene for a given allele that encodes the antigen. Red cells from individuals who are heterozygous for the gene would be expected to express a single dose of the corresponding antigen(s). Red cells with a single-dose expression of an antigen would typically have fewer antigen sites than those that express a double dose and, therefore, may be weakly reactive or nonreactive with a weak example of the corresponding antibody.

Elution

Elution dissociates antibodies from sensitized red cells. Bound antibody may be released by changing the thermodynamics of antigen-antibody reactions, neutralizing or reversing forces of attraction that hold antigen-antibody complexes together, or disturbing the structure of the antigen-antibody binding site. The usual objective is to recover bound antibody in a usable form.

Transfusion Reactions

Acute or immediate transfusion reactions occur within 24 hours of the administration of a component and often during the transfusion. Acute transfusion reactions include immune and nonimmune-mediated hemolysis, transfusion-related sepsis, transfusion-related acute lung injury (TRALI), allergic reactions, transfusion-associated circulatory overload (TACO), sequelae of massive transfusion, air embolism, hypotensive reactions, febrile nonhemolytic transfusion reactions (FNHTRs) and hypothermia. The clinical significance of an acute transfusion reaction often cannot be determined by the patient's clinical history or signs and symptoms alone but requires laboratory evaluation.

Titrations

The titer of an antibody is usually determined by testing serial twofold dilutions of the serum with selected red cells. Results are expressed as the reciprocal of the highest serum dilution that shows macroscopic agglutination. Titration values can provide information about the relative amount of antibody present in a sample or the relative strength of antigen expression on red cells. Titration studies are useful for the following purposes: prenatal studies, antibody identification and separating multiple antibodies.

At-A-Glance Summary Chart

Reference	Results	Conclusions	Key Attribute(s) R = Reliability E = Efficiency C = Confidence	Access Type	Page	Ortho's Solution Referenced
An Exploration of the Advantages of Automated Titration Testing: Low Inter-Instrument Variability and Equivalent Accuracy For ABO and Non-ABO Antibody Titers Relative to Tube Testing Adkins BD, Arnold Egloff SA, Fahey-Ahrndt K, Kjell AL, Cohn CS, Young PP. *Vox Sanguinis*. 2020;115(4):314-322. doi:10.1111/vox.1289	The titration results on ORTHO VISION Analyzer for anti-A and anti-B compared to tube tests were within one dilution with no significant difference statistically. In the inter-laboratory study in which five shared samples were evaluated, four of five of the anti-A titers were concordant and three of the five anti-B tests were concordant using the automated test.	The study showed strong reproducibility for both IgM ABO isoagglutinins as well for IgG alloantibody titrations performed by the automated ORTHO VISION Analyzer. The conclusion was the automated approach provided for an easy to use reproducible assay that reduces the variability of the tube titration assay providing substantial cost and labor savings.	E	*Vox Sanguinis*. 2020;115(4): 314-322. doi:10.1111/ vox.1289	15	ORTHO VISION Analyzer & Antibody Titrations
Extended Antigen Typing on a Fully Automated Immunohematology Analyzer Casina TS, Witkowski R, Roughsedge B, Robb JS, Waite ER, Burrell S. *Transfusion* 2020;60(Suppl.):163A; P-IS-1	Concordance testing demonstrated an overall % agreement of ≥99.0% at LCB95 across 12 of the antisera. The positive test results that were concordant demonstrated consistently ≥2+ reactivity.	The multi-site evaluation demonstrated a high level of concordance. The benefits of automated testing can be achieved using extended antigen typing on a fully automated test platform providing for improved efficiency, reduced potential for error and complete traceability of all test processing. Additional enhanced security is gained through electronically captured test results and reaction grade images. The value this brings to the blood bank/transfusion service in safety and productivity is substantial considering current challenges in workforce resources.	E C	Abstract *Transfusion* 2020;60 (Suppl.):163A; P-IS-1	16	ORTHO VISION Max Analyzer & Extended Antigen Typing (ORTHO SERA® Reagents)
Using a Predictive Connectivity Tool to Evaluate an Automated Immunohematology Instrument Platform to Track and Assess Laboratory Performance Casina TS, Triplett C, Bonanni J. *Vox Sanguinis*. 2020;P-LB-003	In over 22.3 million tests on 1095 ORTHO VISION Analyzer instruments with the full menu of immunohematology tested, the average TAT was 25 minutes (min.), 97% of tests were completed in 40 min. Of the approximate 10.3 million blood grouping tests, the average TAT was 19 min., 97% were completed in less than 33 min. Of all STAT Group A/B detection tests, the average TAT was 30-31 min. depending on whether the test was with a 2 or 3 cell screen. More than 8 million STAT samples tested yielded an average of 23 min. TAT across all tests.	The use of a predictive connectivity tool allows data to effectively be collected which then can be analyzed for laboratory performance. The feedback to laboratory management allows for better understanding of the instrumentation to manage laboratory staff and the workload of the lab. This output can even be used to better understand how an instrument could potentially perform in a laboratory of similar workload and test mix for selecting a new instrument for their laboratory.	R	Abstract *Vox Sanguinis*. 2020;P-LB-003	17	ORTHO VISION Analyzer

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ABO Titers: Harmonization And Identifying Clinically Relevant ABO Antibodies Denomme GA, Anani WQ. *Transfusion*. 2020;60(3):441-443. doi:10.1111/trf.15726	N/A	The authors are supportive of using automation as a tool to improve the awareness of what constitutes safe anti-A and anti-B. "Automation should make the transition a logical decision." The use of the full automation like that of the ORTHO VISION Analyzer provides substantial opportunity to establish the attributes of ABO antibodies that do harm.	C	*Transfusion*. 2020;60(3): 441-443. doi:10.1111/ trf.15726	18	ORTHO VISION Analyzer & Antibody Titrations
Validation of ID-MTS Gel on VISION for Prenatal Testing Rutledge-Harding S, Thomson K, Hindmarsh K, Ciurcovich L, Prokopchuk-Gauk O, Tehseen S, Clarke G. *Transfusion*. 2020;60 (Suppl.);258A;P-TS-53	The titration results on the automated approach were on average 2.45 serial dilutions higher while the median difference was two dilutions higher. Based on this data, two potential critical titers 1:64 and 1:128 were used as comparison to the <16 and ≥16 critical titers to determine the clinical impact on a need for enhanced monitoring of a pregnancy. Using the ≥128 criteria for the automated gel test, four of the 50 cases were missed that would have been identified, necessitating increased monitoring by the traditional tube test 16 criteria.	Using a validated critical titer of 64 in the automated gel test established on the ORTHO VISION Analyzer and ID-MTS Gel Test will be a cautious approach oriented to a safer tactic while triggering needless monitoring in infrequent cases. Further study with the outcome is necessary to evaluate whether the critical titer of 128 could be recognized as an indicator to further offer clinical monitoring.	C	Abstract *Transfusion*. 2020;60 (Suppl.): 258A;P-TS-53	19	ORTHO VISION Analyzer & Antibody Titrations
A Multi-Site Evaluation for Performance of Fully Automated Antigen Typing Casina TS, Witkowski R, Roughsedge B, Robb JS, Waite ER, Burrell S. *Transfusion*. 2019;59(Suppl.):146A; P-IS-2	Concordance testing demonstrated an overall % agreement of ≥99.0% at LCB95 across 12 of the antisera. The positive test results that were concordant demonstrated consistently ≥2+ reactivity.	The multi-site evaluation demonstrated a high level of concordance. The benefits of automated testing can be achieved using extended antigen typing on a fully automated test platform providing for improved efficiency, reduced potential for error and complete traceability of all test processing. Additional enhanced security is gained through electronically captured test results and reaction grade images. The value this brings to the blood bank/transfusion service in safety and productivity is substantial considering current challenges in workforce resources.	E C	Abstract *Transfusion*. 2019:59(Suppl.): 146A;P-IS-2	20	ORTHO VISION Max Analyzer & Extended Antigen Typing ORTHO SERA® Reagents)

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Obstetric Antibody Titers: Clinical Impact of Using the More Sensitive Automated Gel Method Kneib J, Coberly E, Tray K, Stroud D. University of Missouri Health Care. *Transfusion*. 2019;59:(Suppl. 3):207A;P-TS-49	Of the 84 titration sets, 61 sets were RH system antibodies and demonstrated a 2.7-fold higher titer in gel compared to tube. The remaining 23 non-RH system antibodies showed a 1.7-fold higher titer in gel. Of the 84 titration sets evaluated, 80% were concordant with both paired titrations greater than or equal to a titer of 16 or less than a titer of 16.	Based on this study keeping the critical titer at 16 for gel testing does not result in any additional implications for further monitoring. Prospective studies using full automation of titration testing on the ORTHO VISION Analyzer provides the opportunity to realign to an appropriate critical value for the gel test.	C	Abstract *Transfusion*. 2019;59(Suppl. 3):207A;P-TS-49	21	ORTHO VISION Analyzer & Antibody Titrations
Characterization of Prenatal Anti-D Titers by Gel Versus Tube Method: A Meta-Analysis Lieberman L, Andrews J, Adkins BD, Evans M and Cohn CS. *Transfusion*. 2019;59:(Suppl. 3):161A;P-NE-16	After initial analysis, 510 papers were collected including abstracts that were assessed for suitability. There were 32 full-text articles ultimately evaluated, seven of which met the criteria and were evaluated in the final analysis. The review of titer results demonstrated a median titer of eight in-tube tests and 64 in-gel tests.	Generally, gel demonstrated a two-fold higher endpoint compared with tube test titrations. Using a prospective study approach, generating data with statistically valid numbers will help confirm the findings of this study and establish a value that can be utilized to consider the next step diagnostics in prenatal care for alloimmunized prenatal patients.	E C	Abstract *Transfusion*. 2019;59(Suppl. 3):161A;P-NE-16	22	N/A
Are Automated Titration Studies Consistent Over Time? Frost L, Petkova J, Healy M, Lankiewicz M. *Transfusion*. 2018;58(Suppl. 2):139A;INS1	The titration results on ORTHO VISION Analyzer were less than two dilutions different in 100% during the four-week comparison demonstrating consistent titer endpoints. Hands-on time averaged 23 min. versus 3 min. using the ORTHO VISION Analyzer while the TAT averaged 96 min. using manual tube-based titration versus 38 min. fully automated.	The test results from this study demonstrate that the automated method using ORTHO VISION Analyzer delivers a standardized methodology and high reproducibility of results. The use of the full automation that the ORTHO VISION Analyzer provides significant advantages in eliminating considerable labor-intensive activities and time savings.	E C	Abstract *Transfusion*. 2018;58(Suppl. 2):139A;INS1	23	ORTHO VISION Analyzer & Antibody Titrations

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New Automation Results in Improved Transfusion Turnaround Time (TAT) Pelock A, Aronson C. *Transfusion*. 2018; 58(Suppl. 2):142A;INS7	The TAT for the emergency department ranged from 70% to 83% over the 12 months of 2017. The labor and delivery department TAT ranged between 67% and 83% also only achieving the TAT goal in one month of 2017. Once the ORTHO VISON Analyzer was validated and put into routine use, improvement was immediately seen with the first month of 2018, achieving the goal for both departments at 84% to 85%. By the end of the first quarter, the TAT was between 91% and 92% for both departments. Continual improvement has been seen even though a 1% increase in the type and antibody detection test volume.	ORTHO VISION Analyzer provided consistency in predictability of result delivery timing as well as showed an overall improvement in TAT compared to the ORTHO PROVUE® Analyzer, delivering STAT type and antibody detection tests in about 26 min. The ORTHO VISION Analyzer and ORTHO VISION Max Analyzer both have true STAT prioritization capabilities as well as a load as the sample arrives feature, which avoids batching delays that impact sample TAT. A secondary benefit of the ORTHO VISION Analyzer was an improved efficiency in use of reagent red cells, resulting in a 47% decrease in usage and cost savings of ~$1600 per month	E	Abstract *Transfusion*. 2018;58(Suppl. 2):142A;INS7	24	ORTHO VISION Analyzer
ORTHO VISION Automated Analyzers Enable Efficient and Reproducible Measurement of Prenatal Antibody Titers Though Clinical Correlation Studies Are Necessary for Clinical Implementation Adkins B, Maynie P, Chandler C, Garret S, Young P. *Transfusion*. 2017;57(Suppl.):179A; CP299	In-gel titrations were on average 2.77 times higher than the tube test. Antibodies in the RH system averaged 3.2 times greater than tube while non-Rh antibody titers averaged 1.03 higher than the tube test.	A high degree of reproducibility and precision with which the ORTHO VISION Analyzer can achieve. There are higher titer results seen with the gel-based test but the high efficiency and consistency that automated testing of the ORTHO VISION Analyzer provides should be critically considered in changing the standard of practice.	E C	Abstract *Transfusion*. 2017;57(Suppl.): 179A;CP299	25	ORTHO VISION Analyzer & Antibody Titrations

Reference	Results	Conclusions	Key Attribute(s) R = Reliability E = Efficiency C = Confidence	Access Type	Page	Ortho's Solution Referenced
Multi-Center Evaluation of the Automated Immunohematology Instrument, the ORTHO VISION Analyzer Aysola A, Wheeler L, Brown R, Denham R, Colavecchia C, Pavenski K, Krok E, Hayes C, Klapper E. *Lab Med.* 2017;48(1):29-38. doi:10.1093/labmed/lmw061	TAT showed a significant improvement using ORTHO VISION Analyzer with an overall improvement of 12% for all profile tests compared to the ORTHO PROVUE Analyzer. Consistency in TAT was improved by 34%. The type and antibody detection test demonstrated a 13% improvement in TAT. Even in the batch mode there was 30% improvement in reagent red cell usage over the ORTHO PROVUE Analyzer with even greater efficiency at 57% in the random arrival mode tested. The standardized evaluation demonstrated for all the parameters an average rating between 4 to 4.8 for the various parameters considered in the evaluation.	ORTHO VISION Analyzer delivered results with a high level of consistency and predictability compared to the ORTHO PROVUE Analyzer. Reagent usage efficiency vastly improved, eliminating the tendency to batch on the ORTHO PROVUE Analyzer. Highlighted comments focused on the following: loading of samples and reagents continuously, STAT sample processed without delay, select cell feature eliminates manual testing, maintenance wizard makes maintenance easy, serial dilution feature offers standardization and time savings. Overall, stated experience strongly found the ORTHO VISION Analyzer extremely positive and met the laboratory's needs in an automated solution	E	*Lab Med.* 2017;48(1):29-38. doi:10.1093/labmed/lmw061	26	ORTHO VISION Analyzer
Evaluation of the Impact of Advancements of New Automation on Future Challenges Casina TS. *Transfusion*. 2017;57(Suppl. 3):224A;AP32	The future state of testing using ORTHO VISION Analyzer and automated processing of all tests evaluated in the current state assessment, the laboratory achieved improvement in both labor time and cycle time. The total TAT for a type and antibody detection test was often shorter using the ORTHO VISION Analyzer, as samples were held for ECHO testing to avoid waste. Automating antibody identification testing generated an 82% labor improvement with 29 min. of walkaway time over the manual approach. Automating cord blood and titration tests yielded an additional 96% and 80% labor reduction, respectively. Overall, 75 labor hours were recovered moving to the future state.	Based on gains in cost savings, improved efficiency and productivity delivered by ORTHO VISION Analyzer, the transfusion service laboratory has modified the current state workflow process utilized with the ECHO system. Moving all testing to ORTHO VISION Analyzer has delivered significant improvements in TAT and labor time providing adequate staff in times of ongoing resource challenges which allows for focus on other critical transfusion laboratory activities.	E	Abstract *Transfusion*. 2017;57(Suppl. 3):224A;AP32	27	ORTHO VISION Analyzer

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Impact Study of a New Automation System on Transfusion Medicine Operations Casina TS. *Transfusion*. 2017;57(Suppl. 3):251A;AP97	By implementing the future state, an average of 1.3 min. of labor time and vigilant time is saved on each sample loaded for type and antibody detection equating to a 73% labor reduction over the current state. A 19% improvement in TAT on the type and antibody detection was achieved in the future state. Moving from manual antibody identification to automated processing resulted in a 59% labor time reduction. On average, a 38 min. continuous walkaway time is achieved for each automated antibody identification.	The ORTHO VISION Analyzer has demonstrated improvement in lab operations to both the labor required, and result TAT delivery based on the metrics evaluated and compared between the current state and future state. Opportunity exists to automate workflows on other tests that are still manually performed.	E	Abstract *Transfusion*. 2017;57(Suppl. 3):251A;AP97	28	ORTHO VISION Analyzer
Improved Turnaround Time of Type and Screen Samples Hultman M, Holme M, Bakst J, Musa G, Treml A. *Transfusion*. 2017;57(Suppl. 3):254A;AP104	TAT statistics showed a significant improvement using ORTHO VISION Analyzer with an overall improvement for all months. This was a 61% decrease in TAT outliers. The financial impact evaluation showed that an extrapolated one-year cost savings of $134,000 per year based on a better management of testing materials had less repeat testing and technical time of staff to manage testing.	Utilizing a fully automated instrument with bidirectional interfacing and auto-acceptance of test results delivers significantly improved TAT. The use of the full automation design of the ORTHO VISION Analyzer provides substantial cost savings by eliminating considerable labor-intensive activities, consumable waste and repetitive testing.	E C	Abstract *Transfusion*. 2017;57(Suppl. 3):254A;AP104	29	ORTHO VISION Analyzer
Reduction in Repeat Testing Using Gel Technology Mata A, Rich L, Stern S, Wangen S, Van Buskirk C. *Transfusion*. 2017;57(Suppl. 3): 155A;CP237	Thirty No Type Determined specimens from the Immucor NEO were tested on the ORTHO VISION Analyzer. Eleven results produced by ORTHO VISION Analyzer were valid ABO/Rh typing. Eleven of 23 samples that demonstrated positive results on the antibody detection test using the solid phase Capture R Ready Screen test on the Immucor NEO, when tested on the ORTHO VISION Analyzer using the ID-MTS Gel Test were negative. Testing using PEG as an enhancement media in manual tube tests were confirmed to be negative.	Antibody detection testing would result in an estimated 36% reduction in repeat ABO/Rh testing and a 52% reduction in no antibody detected workups by employing the ORTHO VISION Analyzer in the transfusion service. Approximately $74,000 cost savings in reagents, supplies and labor time as a result of the reduction in repeat testing would be realized annually by this implementation.	E	Abstract *Transfusion*. 2017;57(Suppl. 3):155A;CP237	30	ORTHO VISION Analyzer

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A Field Analysis Trial Comparing the Turnaround Times of Routine and STAT Red Blood Cell Immunohematology Testing Sackett K, Kjell A, Schneider AM, Cohn CS. *Immunohematology*. 2017;33(1):1-5.	Overall, the TAT showed a significant improvement using ORTHO VISION Analyzer in comparison to the Immucor ECHO utilizing the load at the time of arrival approach versus waiting for the right size batch to arrive. The average TAT for ORTHO VISION Analyzer was 31 min. compared to 54 min. for the ECHO. More notably was that the standard deviation of result delivery timing was about 7 min. on ORTHO VISION Analyzer versus 19 min. on ECHO demonstrating that ORTHO VISION Analyzer delivers results with a predictable consistent TAT.	ORTHO VISION Analyzer provided consistency in the predictability of result delivery timing as well as a better standardized process timing probability as compared to the Immucor ECHO. An analyzer designed like ORTHO VISION Analyzer to run samples individually as they arrive improves result delivery timing and simultaneously decreases reagent waste.	E	*Immuno-hematology*. 2017;33(1):1-5.	31	ORTHO VISION Analyzer
Automated Eluates: Comparison of Solid-Phase Red Cell Adherence and Gel Automated Eluate Testing Slayten J, Voliva C, Fletcher K, Vaught H, Ingle T. *Transfusion*. 2017;57(Suppl. 3):186A;CP185	The pH of the eluates ranged from 6.9 to 8.1 with 35% at 8.1. Sixteen samples demonstrated the same test results on both instruments. Four samples with DAT-negative results were discordant in eluate testing between the two test systems. Three samples reacted positively on the ECHO and were nonreactive on the ORTHO VISION Analyzer and deemed as false-positive.	This study concluded that eluates can be tested on the base methodology using the automated instruments. There was no root cause or correlation of eluate, color, pH or sample age for the four DAT-negative samples to produce unexplainable positive results. The ORTHO VISION Analyzer and ID-MTS Gel Test was less likely to produce false-positive results in acid eluates as compared to the Immucor ECHO and the Capture Ready solid-phase test.	C	Abstract *Transfusion*. 2017;57(Suppl. 3):186A;CP185	32	ORTHO VISION Analyzer
A Challenge of Blood Type Testing for Multiply Transfused Sickle Cell Disease Patients Slayton J, Ingle T, Heather Vaught H. *Transfusion*. 2017; 57(Suppl. 3):248A; AP89	The manual tests were interpreted as being group O Rh(D) mixed field as did the ORTHO VISION Analyzer identify the results as a mixed field Rh(D) result. The Immucor NEO interpreted the results as No Type Determined.	This study confirmed the conclusions of a previous study of trauma patients in the military transfused with Rh-negative red cells that mixed cell populations are not readily identified by the Immucor ECHO. This was considered a significant threat to mistyping patients without a historical blood type. ORTHO VISION Analyzer was capable of properly identifying these patients with mixed cell results.	C	Abstract *Transfusion*. 2017;57(Suppl. 3):248A;AP89	33	ORTHO VISION Analyzer

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Vision Titers — Easier or Problematic? Slayteon J, Vaught H, Ingle T. *Transfusion*. 2017;57(Suppl. 3): 263A;AP127	The titration results on ORTHO VISION Analyzer were greater than two dilutions different as compared to the tube test in 48% of the samples tested. The remaining samples (52%) were two dilutions different compared to the tube test. Direct costs are reduced by 6%. Most significantly, indirect costs were reduced by 54% for an overall cost reduction of 41% using the ORTHO VISION Analyzer. Using a fully automated system to perform, the serial dilution removes a significant technical hands-on time.	Using a fully automated system to perform, the serial dilution removes a significant technical hands-on time. The use of the full automation that the ORTHO VISION Analyzer provides substantial cost savings by eliminating considerable labor-intensive activities.	E C	Abstract *Transfusion*. 2017;57(Suppl. 3):263A;AP127	34	ORTHO VISION Analyzer & Antibody Titrations
Multi-Site Evaluation for Performance of a Platform Based Fully Automated Immunohematology (IH) Instrument Casina TS, Fanto-Holdaway PA, Jablonski D, Larson J, Roughsedge B, Sauer E, Sawyer B, Schultz T, Witkowski R *Transfusion*. 2016;56(Suppl. 4): 145A;SP290	The system comparison demonstrated a concordance of 99.8% at an LCB95 interval for direct agglutination. The system concordance was 98.7% at the LCB95 interval for AHG tests.	High concordance between the two systems was observed for both direct agglutination and AHG (DAT/IAT) for each site and across all sites combined. The multi-site evaluation demonstrated that the instrument developed, ORTHO VISION Max Analyzer, showed equivalent performance versus the predicate system exceeding the LCB95 concordance acceptance criteria of ≥99.4% for direct agglutination tests and ≥98% for AHG tests in the intended use environment.	E	Abstract *Transfusion*. 2016;56(Suppl. 4):145A;SP290	35	ORTHO VISION Max Analyzer
Evaluation of the Capability of a Fully Automated Immunohematology (IH) Testing Instrument to Perform Serial Dilutions Casina TS, Witkowski R, Eckhardt A. *Transfusion*. 2015;55(Suppl. 3): 133A;SP200	For the ID-MTS Gel Test, 716 reactions were evaluated from both instrument and manual dilution testing, and 358 in the instrument run to run comparisons. This produced an LCB95% of 99.6%. Of the 358, instrument to instrument reactions compared, 357 were within the reaction criteria and achieved a 98.7% LCB95% concordance.	This study demonstrated that the ORTHO VISION Analyzer's serial dilution functionality supports the processing of antibody titration studies. The automated IH test system showed equivalence to the manual serial dilution technique and demonstrated instrument repeatability using the ID-MTS Gel Test.	E C	Abstract *Transfusion*. 2015;55(Suppl. 3):133A;SP200	36	ORTHO VISION Analyzer & Antibody Titrations

Reference	Results	Conclusions	Key Attribute(s) R = Reliability E = Efficiency C = Confidence	Access Type	Page	Ortho's Solution Referenced
Evaluation of Usability of a New Immunohematology Instrument to Meet Regulatory Usability Validation Requirements Casina TS, Warren K, Fanto-Holdaway PA. *Transfusion*. 2015;55(Suppl. 3): 235A;AP59	There were no failures due to a safety-related use error. Twelve failures occurred due to a need for task assistance. The task pass rate ranged from 73% to 100%. Interview feedback rated safety at ≥6.7 on a scale of 1 (least safe) to 7 (most safe). Ease of use was rated ≥6.1 on a scale of 1 (difficult) to 7 (easy).	Using an independent testing entity and a multi-site/multi-user summative usability study, it was shown that the ORTHO VISION Analyzer exhibited a high degree of usability based on the results of testing. There were no safety-related use error failures observed and the validation study was considered successful.	R E C	Abstract *Transfusion*. 2015;55(Suppl. 3):235A;AP59	37	ORTHO VISION Analyzer
Multi-Site Evaluation of Performance of a New Fully Automated Immunohematology (IH) Instrument Casina TS, Connors C, Warren K, Eckhardt A, Fanto-Holdaway PA, Grogan E, Sawyer B, Roughsedge B, Skrobach A. *Transfusion*. 2015;55(Suppl. 3): 132A;SP199	System comparison demonstrated a concordance of 99.9% at an LCB95. The system concordance was 98.6% at the LCB95 interval for AHG tests. The adjusted system concordance was 99.0% at an LCB95 interval for AHG tests.	High concordance between the two systems (ORTHO PROVUE Analyzer and ORTHO VISION Analyzer) was observed for both direct agglutination and AHG test for each site and across all sites combined. The multi-site evaluation demonstrated that the ORTHO VISION Analyzer showed equivalent performance versus the predicate system, exceeding the LCB95 concordance acceptance criteria of ≥99.4% for DA tests and ≥98% for AHG tests in the intended use environment.	E	Abstract *Transfusion*. 2015;55(Suppl. 3):132A;SP199	38	ORTHO VISION Analyzer
Method Comparison Between the ORTHO VISION Analyzer and the ORTHO PROVUE Analyzer Colavecchia C, Patel S, Tanner L, Wendt A, Merkley L, Lin Y, Callum JL. *Transfusion*. 2015;55(Suppl. 3): 131A;SP197	The direct agglutination tests achieved a 100% concordance of 2425 test interpretations. Of the 1347 antiglobulin tests, the concordance ranged between 98.3% and 99.5%. Of 59 antibody identifications, 58 were concordant which produced a 98.3% concordance.	A high level of concordance was achieved at both the microtube and interpretation levels of evaluation. This demonstrates equivalence between the ORTHO VISION Analyzer and the ORTHO PROVUE Analyzer.	E	Abstract? *Transfusion*. 2015;55(Suppl. 3):131A;SP197	39	ORTHO VISION Analyzer

An Exploration of the Advantages of Automated Titration: Low Inter-Instrument Variability and Equivalent Accuracy for ABO and Non-ABO Antibody Titers Relative to the Tube Testing

Adkins BD, Arnold-Egloff SA, Fahey-Ahrndt K, Kjell AL, Cohn CS, Young PP

Vox Sanguinis. 2020;115(4):314-322. doi:10.1111/vox.1289

Objectives: The current titration method for prenatal, transplant and ABO-incompatible plasma blood component titration studies utilize a tube-based method. Studies have shown that there is significant variability among laboratories and even within a laboratory when studies are executed by the tube test. Attempts to minimize variation employ a repeat of the immediate previous sample concurrent with the new sample. Automation of titration studies envision that variability can be diminished and reproducibility improved. This evaluation considered the comparison of using the automated gel method using the ORTHO VISION Analyzer and the ID-MTS Gel Test compared with the tube test to determine if it was possible to decrease variability and improve reproducibility within a laboratory and between laboratories.

Study Design and Methods: Fifteen samples from group O patients were tested by titration for anti-A and anti-B in the manual tube and automated ORTHO VISION Analyzer tests. The automated tests of these samples were conducted in one study site across the three instruments which measured intra-laboratory reproducibility. Where possible, each sample was tested across the three instruments. The titration measured IgM isoagglutinin using the ID-MTS Gel Test buffered gel card. A comparison of inter-laboratory reproducibility by the automated test was completed on five group O samples shared between two study sites. Additionally, 23 samples from alloimmunized patients with either an Rh or non-Rh IgG antibody were evaluated by both tube antiglobulin and the automated ID-MTS Gel Test anti-IgG for comparison of titer endpoints.

Results: The titration results on ORTHO VISION Analyzer for anti-A and anti-B compared to tube tests were within one dilution with no significant difference statistically. Testing of the 30 titrations (15 anti-A and 15 anti-B) across the inter-laboratory instruments, 83% were tested on all three instruments. There was no meaningful difference between single instruments or across all instruments with the applied statistical tests. In the inter-laboratory study in which five shared samples were evaluated, four of five of the anti-A titers were concordant and three of the five anti-B tests were concordant using the automated test. The discordant tests all showed higher titers by one dilution at the originating samples site before they were shipped frozen to the next site. Of the 23 Rh and non-Rh alloantibodies tested across the three analyzers, there was no substantial difference in results between and among the three instruments.

Conclusions: Concurrent testing and comparison of the previous sample and current sample require substantial resources and is highly inefficient. The study showed strong reproducibility for both IgM ABO isoagglutinins as well for IgG alloantibody titrations performed by the automated ORTHO VISION Analyzer. The conclusion was the automated approach provided for an easy-to-use reproducible assay that reduces the variability of the tube titration assay providing substantial cost and labor savings.

Extended Antigen Typing on a Fully Automated Immunohematology Analyzer

Casina TS, Witkowski R, Roughsedge B, Robb JS, Waite ER, Burrell S

Transfusion. 2020;60(Suppl.):163A;P-IS-1

Objectives: Extended antigen typing, mainly executed using manual techniques in tube-based tests, has many failure modes. Testing a single sample with multiple antisera or a single antiserum with many samples along with variable reagent methodology are major hazard contributors amongst the many potentials for error. Automation of immunohematology testing offers considerable risk reduction by minimizing the many error opportunities through process control. Evaluation of an immunohematology testing system is necessary to show that the performance of the instrument demonstrates equivalence from a method-based perspective when compared to results of a predicate method or instrument.

Study Design and Methods: This study involved testing of 13 ORTHO SERA Reagents using ID-MTS Gel Test cards (anti-IgG/buffered) on the ORTHO VISION Max Analyzer to show concordance to a predicate device, the ORTHO VISION Analyzer. Depending on the ORTHO SERA Reagents being tested, an ID-MTS Gel Test anti-IgG card or the ID-MTS Gel Test anti-IgG/buffered gel card testing occurred across three laboratory study sites to evaluate concordance and reproducibility. Thirteen ORTHO SERA Reagents including anti-K, -Fy^{a}, -Fy^{b}, -Jk^{a}, -Jk^{b}, -S, -s, -Le^{a}, -Le^{b}, -P1, -N, D(IAT) and -DVI were tested. Method comparison concordance was assessed by comparison of interpreted tests to determine % concordance between the two automated tests. Each antiserum was evaluated for concordance using a one-sided lower 95% confidence bound (LCB95) calculation. Acceptance criteria was set at LCB95% at greater than or equal to 99% for overall percent agreement. Resolution of discordant tests included repeat testing by both methods and a test by an independent resolution tube test method. Each antisera specificity was tested for reproducibility/repeatability on five non-consecutive days with two runs of two test replicates of the same antigen-positive and negative red cells.

Results: Concordance testing demonstrated an overall % agreement of ≥99.0% at LCB95 across 12 of the antisera. The positive test results that were concordant demonstrated consistently ≥2+ reactivity. There were 19 discordant results across 15,707 tests. Anti-P1 was at 98.8% as the result of the variability of reagents reactivity with four of the seven discordant samples which were P1 weak. Other discordant tests included four manual testing error results, one anti-Fy^{b} test which was weak and confirmed by molecular testing with the remaining 10 discordant results demonstrated atypical weak reactivity which can be flagged on the automated system.

Conclusions: The multi-site evaluation demonstrated a high level of concordance. The benefits of automated testing can be achieved using extended antigen typing on a fully automated test platform providing for improved efficiency, reduced potential for error and complete traceability of all test processing. Additional enhanced security is gained through electronically captured test results and reaction grade images. The value this brings to the blood bank/transfusion service in safety and productivity is substantial considering current challenges in workforce resources.

Using a Predictive Connectivity Tool to Evaluate an Automated Immunohematology Instrument Platform to Track and Assess Laboratory Performance

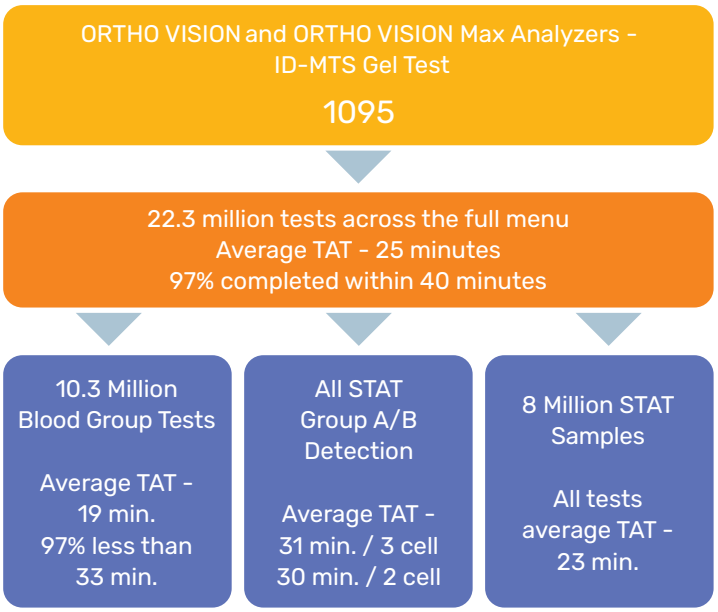
Casina TS, Triplett C, Bonanni J

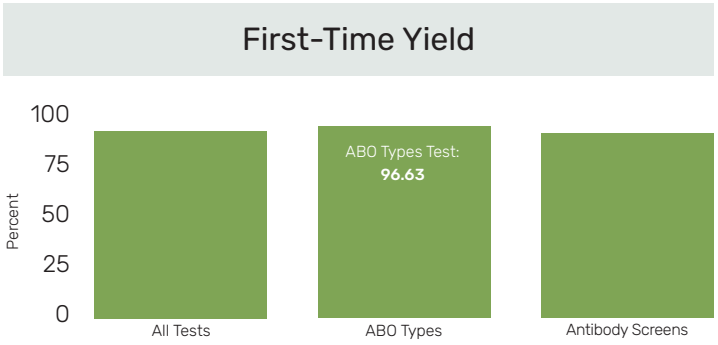
Vox Sanguinis. 2020;P-LB-003

Objectives: There is significant complexity in the testing performed in transfusion medicine such that there are challenges to evaluate the performance of the laboratory and the instrument used by the laboratory. Understanding the capability of the instrument to deliver consistent results to meet the needs of the clinician and patients served is important. A predictive connectivity tool was developed to utilize data that has been collected and analyzed to measure instrument laboratory performance with more realistic performance consideration. The ability to use this tool provides on-demand or routine reporting analysis of performance.

Study Design and Methods: This study utilized data collected from all e-connected ORTHO VISION Analyzer units using the ID-MTS Gel Test over a one-year period to evaluate turnaround time (TAT) for various test profiles/combinations of test profiles. Additionally, a two-month period was used to evaluate data for first-time yield which measures accepted results. The resulting output provided information about TAT by tests, tests per hour and TAT by hour and can be graphically depicted. The raw data can be exported to Excel. The data was further evaluated for first-time yield.

Results: In over 22.3 million tests on 1095 ORTHO VISION Analyzer instruments with the full menu of immunohematology tested, the average TAT was 25 minutes (min.), Ninety-seven percent of tests were completed in 40 min. Of the approximate 10.3 million blood grouping tests, the average TAT was 19 min., 97% were completed in less than 33 min. Of all STAT Group A/B detection tests, the average TAT was 30 to 31 min. depending on whether the test was with a 2 or 3 cell screen. More than 8 million STAT samples tested yielded an average of 23 min. TAT across all tests.





Conclusions: The use of a predictive connectivity tool allows data to effectively be collected which then can be analyzed for laboratory performance. The feedback to laboratory management allows for a better understanding of the instrumentation to manage laboratory staff and the workload of the lab. This output can even be used to better understand how an instrument could potentially perform in a laboratory of similar workload and test mix for selecting a new instrument for their laboratory.

ABO Titers: Harmonization and Identifying Clinically Relevant ABO Antibodies

Denomme GA, Anan WQ

Transfusion. 2020;60(3):441-443. doi:10.1111/trf.15726

Objectives: The focus of this editorial was on the challenges of the true meaning of ABO antibody titers and their value in transfusion and solid organ transplantation. Current objectives of titration are placed on low titer platelets and low titer O whole blood while the transplant titration needs are on the ability to transplant out of group solid organ, mainly kidney transplants. The definition of hemolysin and what constitutes clinically relevant evidence of its capability remains largely unknown in the authors' opinions.

Commentary: Past studies evaluating anti-A and anti-B, along with anti-A, B, are incomplete and questions remain about the targeting of the studies for clinical relevance. The amount of inconsistency in testing methods, red cells used, isoagglutinin components measured and other uncontrolled variables have led to less valued data. Improvements have been made in the semiquantitative titration approach, but methods remain inconsistent amongst laboratories leading to significant interlaboratory variability on endpoint reporting. The authors point to automated solutions as a stabilizing factor in consistency of titration methods. Although isoagglutinin evaluation is targeted towards IgM concentrations for transfusion and IgG for transplants, the question becomes what supports this approach. Automating ABO titers is moving in the proper direction. With automation comes the opportunity to use standardized samples that are made available to assure consistency in reporting of ABO titers. The suggestion that studies that can effectively evaluate data generated by using a standard and automation would help with establishing cutoffs that are globally rational.

Conclusions: Further considerations must be given to what defines a hemolysin for ABO antibody. Further understanding of defining and standardizing red cells used in titration studies is necessary for overall consistency in the measurement of antibody concentration. Both the structural makeup of the A and B antigens as well as quantitative expression need to be considered. What is the true role that A2 antigen has in the picture of successful transplant outcomes? The authors are supportive of using automation as a tool to improve the awareness of what constitutes safe anti-A and anti-B. "Automation should make the transition a logical decision." The use of full automation like that the ORTHO VISION Analyzer provides substantial opportunity to establish the attributes of ABO antibodies that do harm.

Validation of ID-MTS Gel on VISION for Prenatal Testing

Rutledge-Harding S, Thomson K, Hindmarsh K, Ciurcovich L, Prokopchuk-Gauk O, Tehseen S, Clarke G

Transfusion. 2020;60(Suppl.):258A;P-TS-53

Objectives: The most common method used for monitoring prenatal titration studies for the potential of hemolytic disease of the fetus and newborn (HDFN) is a tube-based method. Previous studies have shown gel column-based methods for titration have results with endpoints in the gel test higher than the tube-based method. This evaluation was executed to establish a critical titer threshold with the automated gel method using the ORTHO VISION Analyzer and the ID-MTS Gel Test compared with the tube test endpoints.

Study Design and Methods: Fifty antibody samples that are of potential clinical relevance in pregnancy were identified across the two sites involved in the study. Collected samples were frozen in pairs and one of the pairs was exchanged between the sites. Each site performed the standard method of testing at their site, one site performing the manual tube test and one the automated test method on ORTHO VISION Analyzer. The two methods were compared for difference in number of serial dilutions difference and the average and median titer increases. Critical titer truth tables were established using the established 1:16 critical titer compared to two potential critical titer endpoints in the automated gel at 1:64 and 1:128 based on the average and median data.

Results: The titration results on the automated approach were on average 2.45 serial dilutions higher while the median difference was two dilutions higher. Based on this data, two potential critical titers, 1:64 and 1:128, were used as a comparison to the <16 and ≥16 critical titers to determine the impact on clinical impact on a need for enhanced monitoring of a pregnancy. Using ≥64 as the threshold for additional monitoring, 18 cases were identified by both tube and automated gel testing as meeting the limit to further monitor. Seven cases would have required further monitoring using the 64 gel criteria but would not be using the tube criteria. Using the ≥128 criteria for the automated gel test, four of the 50 cases were missed that would have been identified, necessitating increased monitoring by the traditional tube test 16 criteria.

Conclusions: Using a validated critical titer of 64 in the automated gel test established on the ORTHO VISION Analyzer and ID-MTS Gel Test will be a cautious approach oriented to a safer tactic while triggering needless monitoring in infrequent cases. Further study with outcome is necessary to evaluate whether the critical titer of 128 could be recognized as an indicator to further need of clinical monitoring.

A Multi-Site Evaluation for Performance of Fully Automated Antigen Typing

Casina TS, Witkowski R, Roughsedge B, Robb JS, Waite ER, Burrell S

Transfusion. 2019;59(Suppl.):146A;PIS-2

Objectives: Evaluation of an immunohematology testing system is necessary to show that the performance of the instrument demonstrates equivalence from a method-based perspective when compared to results of a predicate method or instrument. The ORTHO VISION Analyzer is designed to fully automate extended antigen typing using the ID-MTS Gel Test card along with a variety of ORTHO SERA Reagents specificities. A multi-site study was conducted to evaluate the performance of the ORTHO VISION Analyzer automated red cell antigen typing utilizing ORTHO SERA Reagents with specific ID-MTS Gel Test cards compared to the predicate test, the manual ID-MTS Gel Test using the ORTHO® Workstation.

Study Design and Methods: Testing occurred across three laboratory study sites to evaluate concordance and reproducibility. Thirteen ORTHO SERA Reagents including Anti-K, -Fy^a, -Fy^b, -Jk^a, -Jk^b, -S, -s, -Le^a, -Le^b, -P1, -N, D(IAT) and -DVI were tested. Method comparison concordance was assessed by comparison of interpreted tests to determine % concordance between the automated test and the manual test at the one-sided lower bound 95% confidence (LCB95) for the positive % agreement (PPA) and negative % agreement (NPA). Resolution of discordant tests included repeat testing by both methods and a test by an independent resolution tube test method. Any discordant test result that was investigated by the site and found not reproducible by the manual method was deemed a manual use error and excluded from concordance analysis. The LCB95 acceptance criteria for a combined PPA and NPA was ≥99.0%. Each antisera specificity was tested for reproducibility/repeatability on five non-consecutive days with two runs of two test replicates of the same antigen-positive and negative red cells.

Results: Concordance testing demonstrated an overall % agreement of ≥99.0% at LCB95 across 12 of the antisera. The positive test results that were concordant demonstrated consistently ≥2+ reactivity. There were 19 discordant results across 15,707 tests. Anti-P1 was at 98.8% as the result of the variability of reagents reactivity with four of the seven discordant samples which were P1 weak. Other discordant tests included four manual testing error results, one anti-Fy^b test which was weak and confirmed by molecular testing with the remaining 10 discordant results demonstrated atypical weak reactivity which can be flagged on the automated system.

Conclusions: The multi-site evaluation demonstrated a high level of concordance. The benefits of automated testing can be achieved using extended antigen typing on a fully automated test platform providing for improved efficiency, reduced potential for error and complete traceability of all test processing. Additional enhanced security is gained through electronically captured test results and reaction grade images. The value this brings to the blood bank/transfusion service in safety and productivity is substantial considering current challenges in workforce resources.

Obstetric Antibody Titers: Clinical Impact of Using the More Sensitive Automated Gel Method

Kneib J, Coberly E, Tray K, Stroud D

Transfusion. 2019;59(Suppl. 3):207A;P-TS-49

Objectives: The use of antibody titration test results plays an important role in prenatal care of alloimmunized pregnant patients. The use of the gel test is highly desirable to perform these titrations since it has better precision and standardization as compared to standard of practice tube tests. Additionally, using a fully automated approach minimizes the hands-on time and eliminates the variability of manual sample preparation and testing. A titer result of 16 using tube-based tests is considered a critical titer in which further clinical evaluation for HDNF should be considered. This study evaluated the possible clinical impact of employing a fully automated gel test for performance of titrations.

Study Design and Methods: Testing was completed using 84 titration sets in 40 patients. All patients with clinically relevant antibody with the potential to be implicated in HDNF were evaluated with a manual tube and automated ORTHO VISION Analyzer titration tests with the ID-MTS Gel Test were done on two-fold serially diluted samples. The endpoint was the last serial dilution producing a 1+ reaction for both methods. Clinical outcomes were captured including mid-cerebral artery Doppler results, neonatal bilirubin, DAT and hemoglobin results as well as any phototherapy and transfusion treatment. Concordance between the tube and automated gel test was evaluated based on whether both tests demonstrated a titer of 16 or greater or less than 16.

Results: Of the 84 titration sets 61 sets were RH system antibodies and demonstrated a 2.7-fold higher titer in gel compared to tube. The remaining 23 non-RH system antibodies showed a 1.7-fold higher titer in gel. Of the 84 titration sets evaluated, 80% were concordant with both paired titrations greater than or equal to a titer of 16 or less than a titer of 16. Of the 20% (eight cases with anti-D) that showed a discordant titration result between gel and tube tests, seven had clinical outcome data. One patient, despite having a tube titer at 4 and a gel titer result at 16, had clinically significant HDNF requiring treatment. The remaining six discordant cases did not have indications of HDNF.

Conclusions: Based on this study keeping the critical titer at 16 for gel testing does not result in any additional implications for further monitoring. Further studies are necessary to determine if establishing a critical titer value for gel would alleviate apprehensions when titers at current clinical critical values are encountered and potentially trigger further clinical surveillance. Prospective studies using full automation of titration testing on the ORTHO VISION Analyzer provide the opportunity to realign to an appropriate critical value for the gel test.

Characterization of Prenatal Anti-D Titers by Gel Versus Tube Method: A Meta-Analysis

Lieberman L, Andrews J, Adkins BD, Evans M, Cohn CS

Transfusion. 2019;59(Suppl. 3):161A;P-NE-16

Objectives: Prenatal antibody titers are useful in predicting the potential for further obstetrical assessment for the potential of HDNF. The current titration method for prenatal titration studies is a tube-based method. Previous studies have evaluated gel column-based methods for titration with results indicating that endpoints in the gel test may be higher compared to the tube-based method. This study analyzed the available references of anti-D prenatal titrations to establish a relationship between the gel method and tube method for use in prenatal testing.

Study Design and Methods: Publications were collected by a search in Medline and EMBASE between 1946-2019 for original research that had a minimum of five sets of comparative test results for titration of anti-D by tube and gel for inclusion in the analysis. Data that was collected on each paper included the number of paired titrations, the titer endpoint on each, the phenotype of red cell used in the titration, the diluent used for dilutions, red cell concentration and incubation time.

Results: After initial analysis, 510 papers were collected including abstracts that were assessed for suitability. There were 32 full-text articles that were ultimately evaluated, seven of which met the criteria and were evaluated in the final analysis. Of the 373 gel tube paired titrations, the phenotype of cells used was 23% R1R1, 44% R2R2, 12% R1R2 and 22% Ror. Saline was used for serial dilutions. Tube testing used a saline-based test while 97% of gel tests were LISS-based. The cell suspension most frequently used was 3% (66%) while the remainder most often used 2%. The review of titer results demonstrated a median titer of eight in tube tests and 64 in gel tests.

Conclusions: Generally, gel tests demonstrated a two-fold higher endpoint compared with tube test titrations. A mean standardization value may be applicable to relating tube and gel test results for titrations in prenatal samples. Using a prospective study approach generating data with statistically valid numbers will help confirm the findings of this study and establish a value that can be utilized to consider next-step diagnostics in prenatal care for alloimmunized prenatal patients.

Are Automated Titration Studies Consistent Over Time?

Frost L, Petkova J, Healy M, Lankiewicz M

Transfusion. 2018;58(Suppl. 2):139A;INS1

Objectives: Studies have evaluated gel column-based methods for titration with results indicating that endpoints in the gel test may be higher compared to the tube-based method. This study was done as part of their implementation plan moving from tube to automated titration testing. This evaluation used the automated gel method employing the ORTHO VISION Analyzer and the ID-MTS Gel Test and compared the titration endpoints over time of 0.8% reagent red cells for consistency.

Study Design and Methods: Testing was completed over a five-week period. Samples with antibodies from four different blood group systems were evaluated: three anti-Jk^{a}, three anti-K, two anti-Fy^{a}, one anti-Fy^{b}, two anti-E and one anti-e. Reagent red cells from ORTHO RESOLVE® Panel A or B were tested starting with a fresh panel and retested using the same cell paired with the same sample for four consecutive weeks. The phenotype of cell used was consistent across the antibody specificity tested. All testing was automated on ORTHO VISION Analyzer using the ID-MTS Gel Test anti-IgG card. Testing on the fifth week was completed with a fresh reagent red cell. The endpoint was the last serial dilution producing a 1+ reaction for both methods. The results were evaluated based on a less than two serial dilution difference versus a greater than two serial dilution difference. An analysis of hands-on time and TAT were analyzed as well as comparison.

Results: The titration results on ORTHO VISION Analyzer were less than two dilutions different in 100% during the four-week comparison demonstrating consistent titer endpoints. Results of the fifth week, when fresh cells were tested, were within one dilution in 83.3% (10 of 12) samples. One example of anti-K and the anti-Fy^{b} demonstrated two dilution differences. Hands-on time averaged 23 min. versus 3 min. using the ORTHO VISION Analyzer while the TAT averaged 96 min. using manual tube-based titration versus 38 min. fully automated.

Conclusions: The test results from this study demonstrate that the automated method using ORTHO VISION Analyzer delivers a standardized methodology and high reproducibility of results. The within one dilution difference expectation was consistently delivered with the same red cell and phenotype. Further, when fresh cells were used the two-fold threshold from the original result was not exceeded. The data indicates that the age of in-date reagent red cells deliver consistency with no significant bearing on titration endpoints. Even when different individual reagent red cells are used, the random variations in antigen expression may produce results that are at a maximum of two dilutions different but most often one dilution difference. The use of the full automation of the ORTHO VISION Analyzer provides significant advantages in eliminating considerable labor-intensive activities and time savings.

New Automation Results in Improved Transfusion Turnaround Time (TAT)

Pelock A, Aronson C

Transfusion. 2018;58(Suppl. 2):142A;INS7

Objectives: Achieving a goal of at least 83% of the type and antibody detection tests being completed within 90 min. of test order and sample received assures meeting patient and clinician needs in the emergency room and labor and delivery departments. This goal was routinely monitored beginning in 2015 with the intent to evaluate the data yearly to confirm the TAT was met. The collected data showed the combined emergency room and labor/delivery goal was met in 2015 (88%), just achieved in 2016 (84%) and not attained in 2017 at 76%. Concurrent to the deteriorating TAT, performance was a substantial increase of 27% for the type and antibody detection test volume from ~26,000 tests in 2015 to ~33,000 tests in 2017.

Study Design and Methods: Starting in 2017, the two departments' TAT data was monitored on a monthly basis. Data collected included date and time of receipt, completion of testing and issue of blood products in the computer system. The ORTHO PROVUE Analyzer was in place between 2015 and 2017. In 2017, approval was achieved for the purchase of ORTHO VISION Analyzers including one ORTHO VISION Max Analyzer and one ORTHO VISION Analyzer. Data was then collected for the new instruments which were implemented starting in 2018.

Results: The TAT for the emergency department ranged from 70% to 83% over the 12 months of 2017 with only one month achieving the 83% goal. The labor and delivery department TAT ranged between 67% and 83%, also only achieving the TAT goal in one month of 2017. Once the ORTHO VISION Analyzer was validated and put into routine use, improvement was immediately seen with the first month of 2018 achieving the goal for both departments at 84% to 85%. By the end of the first quarter, the TAT was between 91% and 92% for both departments. Continual improvement has been seen, even though a 1% increase in the type and antibody detection test volume.

Conclusions: ORTHO VISION Analyzer provided consistency in predictability of result delivery timing as well as showed an overall improvement in TAT compared to the ORTHO PROVUE Analyzer, delivering STAT type and antibody detection tests in about 26 minutes. The ORTHO VISION Analyzer and ORTHO VISION Max Analyzer both have true STAT prioritization capabilities as well as a load as the sample arrives feature which avoids batching delays that impact sample TAT. A secondary benefit of the ORTHO VISION Analyzer was improved efficiency in use of reagent red cells resulting in a 47% decrease in usage and a cost savings of ~$1600 per month.

ORTHO VISION Automated Analyzers Enable Efficient and Reproducible Measurement of Prenatal Antibody Titers Though Clinical Correlation Studies Are Necessary for Clinical Implementation

Adkins B, Maynie P, Chandler C, Garret S, Young P

Transfusion. 2017;57(Suppl.):179A;CP299

Objectives: Titration is an important technique for both prenatal and transplant services. Studies are necessary to evaluate the gel test to replace the tube-based method of titration which has been the standard of practice. This evaluation considered the comparison of using the automated gel method using the ORTHO VISION Analyzer and the ID-MTS Gel Test compared with the tube test as well as interinstrument reproducibility.

Study Design and Methods: Testing was complete using 26 samples that had IgG antibody with both RH and non-Rh antibodies (nine anti-D, eight anti-E, three anti-Fy^a, three anti-K, one anti-Jk^a and one anti-M. Both manual tube and automated ORTHO VISION Analyzer tests were done with two-fold serially diluted samples and double dose antigen-positive reagent red cells. The endpoint was the last serial dilution producing a 1+ reaction for both methods. Testing was accomplished using the three ORTHO VISION Analyzers in the laboratory. Ten of the samples were tested across all three systems while the remaining samples were tested on two of the three systems. The results were evaluated by the number of serial dilutions difference.

Results: The study results demonstrated that in gel titrations were on average 2.77 times higher than the tube test. Antibodies in the RH system averaged 3.2 times greater than tube while non-Rh antibody titers averaged 1.03 higher than tube. Notably, the variation between analyzers was minimal, having a coefficient of variation between 0 and 0.5 with an average of 0.3. The three ORTHO VISION Analyzers delivered the same endpoints in 19 of the 26 samples. For those samples with a difference, there was only one dilution difference in the endpoint seen.

Conclusions: Testing demonstrated the high degree of reproducibility and precision with which the ORTHO VISION Analyzer can achieve. Granted there are higher titer results seen with the gel-based test but the high efficiency and consistency that automated testing of the ORTHO VISION Analyzer provides should be critically considered in changing the standard of practice. Further studies will establish new critical titer ranges that will be used to monitor pregnancies.

Multi-Center Evaluation of the Automated Immunohematology Instrument, the ORTHO VISION Analyzer

Aysola A, Wheeler L, Brown R, Denham R, Colavecchia C, Pavenski K, Krok E, Hayes C, Klapper E

Lab Med. 2017;48(1):29-38. doi:10.1093/labmed/lmw061

Objectives: This study evaluated and rated the ORTHO VISION Analyzer based on the following factors: training, system configuration, quality control, maintenance activities and validation of the system in performing testing for efficiency and ease of use along with the serial dilution and remote result review features. Additionally, a timing study for TAT and a reagent red cell use efficiency comparison of the instrument to the ORTHO PROVUE Analyzer was undertaken. Five independent sites were involved in the execution of the study to attain breadth of feedback.

Study Design and Methods: Both key operators and general operators were trained to use the instrument using online and onsite training. A standardized evaluation was performed using a rating scale of 1 to 5 (1 low to 5 high) after system use by site to evaluate various parameters described in the objective section. Each site performed system efficiency testing using standard laboratory arrival patterns of samples load upon arrival on ORTHO VISION Analyzer versus a batch mode or a load as soon as accessible on ORTHO PROVUE Analyzer. TAT improvement and consistency were measured. Study of the reagent red cell usage comparison employed two test cases involving 36 type and antibody detection test samples; 1) loaded in four batches 2) load at 13 different time intervals in a defined arrival pattern. Reagent usage was measured and compared after completion of the test cases.

Results: TAT showed a significant improvement using ORTHO VISION Analyzer with an overall improvement of 12% for all test profile tests compared to the ORTHO PROVUE Analyzer. Consistency in TAT was improved by 34%. The type and antibody detection test demonstrated a 13% improvement in the TAT. Even in the batch mode, there was a 30% improvement in reagent red cell usage over the ORTHO PROVUE Analyzer with even greater efficiency at 57% in the random arrival mode tested. The standardized evaluation demonstrated for all the parameters an average rating between 4 and 4.8 for the various parameters considered in the evaluation.

Conclusions: ORTHO VISION Analyzer delivered results with a high level of consistency and predictability compared to the ORTHO PROVUE Analyzer. Reagent usage efficiency vastly improved eliminating the tendency to batch on the ORTHO PROVUE Analyzer. Highlighted comments focused on the following: loading of samples and reagents continuously, STAT sample processed without delay, select cell feature eliminating manual testing, maintenance wizard making maintenance easy, serial dilution feature offering standardization and time savings. Overall stated experience strongly found the ORTHO VISION Analyzer extremely positive and met the laboratory's needs in an automated solution.

Evaluation of the Impact of Advancements of New Automation on Future Challenges

Casina TS

Transfusion. 2017;57(Suppl. 3):224A;AP32

Objectives: The ongoing challenges of recruiting qualified medical technologists into transfusion medicine often stretch the capacity of the transfusion service to meet the patient care needs expected by clinicians. Automation has had a positive impact to counterbalance these challenges. The only automated testing done by this laboratory was the type and antibody detection test, averaging about 60 to 70 tests per day. STAT type and antibody detection tests were not necessarily completed by the current state automation depending on instrument status. All other testing profiles were completed manually in tube. This study evaluated the potential impact gains of a future state instrument ORTHO VISION Analyzer compared with a current state instrument Immucor ECHO.

Study Design and Methods: The study was conducted in two phases using a current state/future state approach. Direct observation of processes employing timing studies was used to compare workflows utilizing the two instruments. Evaluation consistency was achieved by using at least three observations of each process and results averaged. The metrics evaluated were for cycle timing for manual labor/instrument time, TAT and consumable waste.

Results: The current state timing for Type and Ab detection on ECHO was approximately 33 min., while the manual tests approximate times included STAT Type and Ab detection 22 min., antibody identification of 35 min., patient ABO/RH of 3 to 4 min., cord blood test of 14 min. and titration of 85 min. Most of the measured time for manual tests was in labor and technologist presence. The waste generated by the ECHO equated to 40% of all solid phase strips tested. As a measure to avoid waste, holding samples to batch process was observed in some cases leading to longer TAT. Frequently, STAT tests were directed to the manual workbench to circumvent waste. With the future state of testing using ORTHO VISION Analyzer and automated processing of all tests evaluated in the current state assessment, the laboratory achieved improvement in both labor time and cycle time. The approximate cycle times in the future state were Type and Ab detection at 31 min., antibody identification at 33 min., patient ABO/RH at 13 min., cord blood test at 17 min. and titration at 35 min. The total TAT for a type and antibody detection test was often shorter using the ORTHO VISION Analyzer as samples were held for ECHO testing to avoid waste. Automating antibody identification testing generated an 82% labor improvement with 29 min. of walkaway time over the manual approach. Automating cord blood and titration tests yielded an additional 96% and 80% labor reduction, respectively. Overall, 75 labor hours were recovered by moving to the future state.

Conclusions: Based on gains in cost savings, improved efficiency and productivity delivered by ORTHO VISION Analyzer, the transfusion service laboratory has modified the current state workflow process utilized with the ECHO system. Moving all testing to ORTHO VISION Analyzer has delivered significant improvements in TAT and labor time providing adequate staff in times of ongoing resource challenges which allows for focus on other critical transfusion laboratory activities.

Impact Study of a New Automation System on Transfusion Medicine Operations

Casina TS

Transfusion. 2017;57(Suppl. 3):251A;AP97

Objectives: When evaluating a new instrument solution for pre-transfusion testing, it is important to consider the operational impact of the system on the lab. There are a variety of operational, performance and system metrics that can be evaluated to determine this impact, including test workflow, hands-on time and automation time. This study involved a current state to a future state comparison of testing processes with an instrument ORTHO PROVUE Analyzer and manual testing versus an instrument ORTHO VISION Analyzer.

Study Design and Methods: Data collection methods encompassed direct observation, time studies and interviews. The ORTHO PROVUE Analyzer was used for type and antibody detection tests and the manual ID-MTS Gel Test for antibody identification/selected cell panels. All other testing including cord blood, DAT, unit confirm, patient type confirmation and crossmatch were done manually in tube. The future state incorporated the ORTHO VISION Analyzer. The type and antibody detection, antibody identification and unit confirmation were evaluated in both states. A measurement of cycle time was averaged based on three-run cycles and was comprised of three metrics: instrument time, standby time and labor time. Standby time may be comprised of two components, time that could be utilized as “walkaway” time or vigilant time which requires operator presence but not operator action. For automated instruments, vigilant time for each cycle was measured as instrument access unavailable. Instrument daily maintenance cycle time was evaluated as well. Similarly, timing of manual tube test processes used these metrics. For unit confirmation, a time per individual process was captured and then multiplied per unit.

Results: By implementing the future state, an average of 1.3 min. of labor time and vigilant time is saved on each sample loaded for type and antibody detection, equating to a 73% labor reduction over the current state. A 19% improvement in TAT on the type and antibody detection was achieved in the future state. Moving from manual antibody identification to automated processing resulted in a 59% labor time reduction. On average, a 38 min. continuous walkaway time is achieved for each automated antibody identification. Unit confirmation testing was less impacted as there was a minimal difference however allowed for focus on consistency in testing approach and quality metrics.

Conclusions: The ORTHO VISION Analyzer has demonstrated improvement in lab operations to both the labor required and result TAT delivery based on the metrics evaluated and compared between the current state and future state. Opportunity exists to automate workflows on other tests that are still manually performed.

Improved Turnaround Time of Type and Screen Samples

Hultman M, Holme M, Bakst J, Musa G, Treml A

Transfusion. 2017;57(Suppl. 3):254A;AP104

Objectives: The transfusion medicine laboratory TAT was affected by a temporary move in their facility for construction purposes. The result of this move prevented the use of their routine test method and automation of the Immucor Galileo NEO and the solid phase test instead of using the ID-MTS Gel Test manually. Substantial increases as high as 104% in TAT outliers despite test volumes that were consistent with previous months. Upon return to the original laboratory and automated solid phase methodology, there was no improvement back to the TAT performance prior to the move. Two ORTHO VISION Analyzers were evaluated for performance to meet the expectation of the laboratory TAT requirements.

Study Design and Methods: The two ORTHO VISION Analyzers were set up with a bidirectional interface and auto-accept criteria to allow transfer results where they were reviewed and accepted by technologists. Any results that did not meet the criteria for auto-acceptance were held at the instrument level for further review. Furthermore, the workflow approach was modified from a batch approach to a load as the sample arrives approach. Data was captured and analyzed for TAT and measured as a percent of tests meeting expectations of the 80-min. criteria. Further study was undertaken to understand whether there was any financial impact of the new testing process. This process, as the result of instrument design, also eliminated the need for repetitious loading of consumables to perform testing. This was monitored over an implementation period and through routine use after going live.

Results: TAT statistics showed a significant improvement using ORTHO VISION Analyzer with an overall improvement for all months, meeting the criteria between 91% to 95% of the time during the implementation phase and after live routine use between 96% to 98%. This was a 61% decrease in TAT outliers. The financial impact evaluation showed that an extrapolated one-year cost savings of $134,000 per year based on better management of testing materials, less repeat testing and technical time of staff to manage testing.

Conclusions: Utilizing a fully automated instrument with bidirectional interfacing and auto-acceptance of test results delivers significantly improved TAT. The use of the full automation design of the ORTHO VISION Analyzer provides substantial cost savings by eliminating considerable labor-intensive activities, consumable waste and repetitive testing.

Reduction in Repeat Testing Using Gel Technology

Mata A, Rich L, Stern S, Wangen S, Van Buskirk C

Transfusion. 2017;57(Suppl. 3):155A;CP237

Objectives: Laboratory management decided that it would be of value to understand how different methodologies perform as compared to their current approach. This laboratory executed a side-by-side evaluation of the ORTHO VISION Analyzer and ID-MTS Gel Test technology versus what was their current test system, the Immucor NEO, to perform ABO/Rh and antibody detection testing utilizing solid-phase technology. When results from the Immucor NEO were unattainable, repeat testing was undertaken with manual testing using tube testing. Reagents, supplies and technical time were captured to evaluate the impact of repeat testing on laboratory budget based on the amount of repeat manual tube testing that needed to be performed.

Study Design and Methods: Thirty specimens that were processed on the Immucor NEO and resulted in No Type Determined for ABO/Rh testing were selected to be tested on the ORTHO VISION Analyzer. Twenty-three specimens that were processed on the Immucor NEO and produced positive results for antibody detection testing were tested on the ORTHO VISION Analyzer.

Results: Thirty No Type Determined specimens from the Immucor NEO were tested on the ORTHO VISION Analyzer, eleven results produced by the ORTHO VISION Analyzer were valid ABO/Rh typing. Three of these results were initially flagged with possible discrepant results that required a further visual review. After review, these results were determined to have a valid typing present. Nineteen samples required a manual tube test to interpret the ABO/Rh. Tube testing confirmed that the discrepancies encountered as No Type Determined were due to mixed field, weak isoagglutinins, unexplained extra reactivity and hemolysis. Eleven of 23 samples that demonstrated positive results on the antibody detection test using the solid phase Capture R Ready Screen test on the Immucor NEO, when tested on the ORTHO VISION Analyzer using the ID-MTS Gel Test, were negative. Testing using polyethylene glycol as an enhancement media in manual tube tests was confirmed to be negative. One specimen was identified as a fibrin reaction, but upon performing a visual review, was determined to be negative. Anti-M was identified in one sample that was seen in gel but not confirmed in the PEG tube test and one sample displayed unexplained reactivity in both solid phase and the gel test but was negative in tube and all clinically significant antibodies were ruled out. Nine specimens that were positive on the Immucor NEO were also positive on the ORTHO VISION Analyzer.

Conclusions: This study demonstrated the ORTHO VISION Analyzer and the ID-MTS Gel Test compared to the Immucor Galileo NEO microplate for ABO/Rh and Capture R Ready antibody detection testing would result in an estimated 36% reduction in repeat ABO/Rh testing and a 52% reduction in no antibody detected workups by employing the ORTHO VISION Analyzer in the transfusion service. Approximately $74,000 cost savings in reagents, supplies and labor time as a result of the reduction in repeat testing would be realized annually by this implementation.

A Field Analysis Trial Comparing the Turnaround Times of Routine and STAT Red Blood Cell Immunohematology Testing

Sackett K, Kjell A, Schneider AM, Cohn CS

Immunohematology. 2017;33(1):1-5.

Objectives: Two metrics were the focus of this paper 1) turnaround time (TAT) - the time between sample arrival and result availability and 2) processing time - the time from when work starts on a sample; whether by manual testing or by loading it onto an analyzer, to its result availability. The study concentrated on workflow efficiency utilizing the ORTHO VISION Analyzer in comparison to testing on the Immucor ECHO and manual test methods.

Study Design and Methods: Laboratory personnel were trained on the use of ORTHO VISION Analyzer with the standard training tools for both key operator and general operator training and employed both online and onsite executed after instrument installation. System efficiency was evaluated using standard laboratory arrival patterns of samples with load upon arrival on ORTHO VISION Analyzer versus a laboratory's standard practice of batch mode loading typically employed on the Immucor ECHO. System process time and TAT were evaluated and compared between ORTHO VISION Analyzer and Immucor ECHO. Workflow and result delivery timing was also evaluated for manual testing versus the ORTHO VISION Analyzer for various test combinations using a sequential and concurrent approach. Although not measured as a metric consideration to reagent waste due to process being subjectively judged.

Results: Overall, the TAT showed a significant improvement using Ortho VISION Analyzer in comparison to the Immucor ECHO utilizing the load at the time of arrival approach versus waiting for the right size batch to arrive. The average TAT for ORTHO VISION Analyzer was 31 min. compared to 54 min. for the Immucor ECHO. More notably was that the standard deviation of result deliver timing was about 7 min. on ORTHO VISION Analyzer versus 19 min. on Immucor ECHO, demonstrating that ORTHO VISION Analyzer delivers results with a predictable consistent TAT. Processing time on the instruments was generally similar with times within 1 to 5 min. of each other; however, using standard deviation comparison of 2.09 on ORTHO VISION Analyzer versus Immucor ECHO 3.39 showing a better prediction of process time can be achieved on ORTHO VISION Analyzer. When comparing manual testing of various combinations of test profiles versus testing completed on ORTHO VISION Analyzer sequentially (usually the most common workflow) showed 20% to 80% improvement in result delivery times.

Conclusions: ORTHO VISION Analyzer provided consistency in predictability of result delivery timing as well as a better standardized process timing probability as compared to the Immucor ECHO. When comparing the workflow of analyzers, there should be considered beyond the metric of overall TAT. Systems that use multiple test disposables with no ability for reuse of unused tests may endure extended TATs from a batching process or waste when only a partial batch is tested. An analyzer designed like ORTHO VISION Analyzer to run samples individually as they arrive improves result delivery timing simultaneously decreasing reagent waste. This is of particular concern for STAT sample testing. ORTHO VISION Analyzer performed each test faster than manual testing when ran in parallel or when tested sequentially.

Automated Eluates: Comparison of Solid-Phase Red Cell Adherence and Gel Automated Eluate Testing

Slayten J, Voliva C, Fletcher K, Vaught H, Ingle T

Transfusion. 2017;57(Suppl. 3):186A;CP185

Objectives: Standard acid eluate testing has been typically executed using tube indirect antiglobulin methods including concurrent last wash control testing. It has been previously established that acid eluates can be tested by the gel column-based tests. This study was undertaken with the aim to test acid eluates utilizing automated test systems employing the instruments-based test methodology. Two instruments and technologies were compared.

Study Design and Methods: A total of 20 samples were used in testing, two with a >2+ DAT, two with a weak positive DAT and 16 with negative DAT tests. Acid eluates using a commercial kit were prepared from each sample and a last wash retained for testing in parallel. Each eluate was pH tested with pH paper and observed for various shades of blue color (blue-green, blue-brown and blue-purple). Prior to testing, each eluate and last wash was centrifuged twice for five minutes to remove any possibility of debris that could cause false-positive reactions. Testing of each eluate and last wash was completed on the ORTHO VISION Analyzer with the ID-MTS Gel Test using the gel card and on the Immucor ECHO system using the Capture Ready solid-phase test. Antibody detection cells were initially tested and then any positive result was tested with an antibody identification panel to identify antibody specificity of the positive detection result.

Results: The pH of the eluates ranged from 6.9 to 8.1 with 35% at 8.1. The eluate colors were 14 blue-green, five blue brown and one blue-purple. Sixteen samples demonstrated the same test results on both instruments. Four samples with DAT-negative results were discordant in eluate testing between the two test systems. Three samples reacted positively on the Immucor ECHO and were nonreactive on the ORTHO VISION Analyzer and deemed as false-positive. One sample was positive on the ORTHO VISION Analyzer and nonreactive on the Immucor ECHO and concluded as being a false-positive. All four samples had a blue-green color and a pH below 7.6 with two of the samples at a pH of 6.9.

Conclusions: This study concluded that eluates can be tested on the base methodology using automated instruments. There was no root cause or correlation of eluate, color, pH or sample age for the four DAT-negative samples to produce unexplainable positive results. The ORTHO VISION Analyzer and ID-MTS Gel Test was less likely to produce false-positive results in acid eluates as compared to the Immucor ECHO and the Capture Ready solid-phase test. It was concluded that more extensive testing would allow for a root cause determination of the false-positive results seen.

A Challenge of Blood Type Testing for Multiply Transfused Sickle Cell Disease Patients

Slayton J, Ingle T, Heather Vaught H

Transfusion. 2017;57(Suppl. 3):248A;AP89

Objectives: The current primary method of testing of sickle cell disease patients has challenged the transfusion service to assign a proper blood type of these patients particularly when multiply transfused. The laboratory's current instrument stated limitation is that reaction scores of 11 or fewer in a tube-based test may not be effectively read providing for the potential of a result that could be positive, negative or ambiguous at best when reading test results in mixed field circumstances. The instrument does not generate mixed-field results when present. The purpose of evaluating the ORTHO VISION Analyzer and the ID-MTS Gel Test was to determine its capability to identify mixed-field reactivity when present in sickle cell disease patients who have been multiply transfused. The two instruments and technologies were compared.

Study Design and Methods: Two sickle cell disease patients who originally typed as O Rh(D)-positive and received eight to 10 packed red cells of O Rh(D)-negative packed red cells in an exchange transfusion greater than 30 days prior to testing. Testing was initially performed on the Immucor ECHO and then subsequent testing was completed using a manual tube test with two Anti-D reagents, as well as the ORTHO VISION Analyzer and the Immucor Galileo NEO the test results and interpretations by the instrument were evaluated and compared.

Results: The initial test results on the Immucor ECHO did not signal that the results were ambiguous identifying the result as O Rh-negative on both patients. The manual tests were interpreted as being group O Rh(D) mixed field as did the ORTHO VISION Analyzer identify the results as a mixed-field Rh(D) result. The Immucor Galileo NEO interpreted the results as No Type Determined.

Conclusions: This study confirmed the conclusions of a previous study of trauma patients in the military transfused with Rh-negative red cells that mixed cell populations are not readily identified by the Immucor ECHO. Further, the study identified that consideration should be given to retype first-time sickle cell patients with manual methods so that mixed-cell populations that cannot be interpreted by some instrument readers are accurately typed. This was considered a significant threat to mistyping patients without a historical blood type. ORTHO VISION Analyzer was capable of properly identifying these patients with mixed cell results.

Vision Titers — Easier or Problematic?

Slayton J, Vaught H, Ingle T

Transfusion. 2017;57(Suppl. 3):263A;AP127

Objectives: The current titration method for prenatal titration studies is a tube-based method. Previous studies have evaluated gel column-based methods for titration with results indicating that endpoints in the gel test may be higher compared to the tube-based method. This evaluation considered the comparison of using the automated gel method using the ORTHO VISION Analyzer and the ID-MTS Gel Test compared with the tube test endpoints as well as the cost-effectiveness of each test method.

Study Design and Methods: Testing was complete using 23 previously tested retained samples. Both manual and automated ORTHO VISION Analyzer tests were done on two-fold serially diluted samples. The endpoint was the last serial dilution producing a 1+ reaction for both methods. The results were evaluated based on a less than two serial dilution difference versus a greater than two serial dilution difference. An analysis of cost including both direct and indirect costs for each of the methods was completed.

Results: The titration results on ORTHO VISION Analyzer were greater than two dilutions different as compared to the tube test in 48% of the samples tested. The remaining samples (52%) were two dilutions different compared to the tube test. Direct costs were reduced by 6%. Most significantly, indirect costs were reduced by 54% for an overall cost reduction of 41% using the ORTHO VISION Analyzer. Using a fully automated system to perform the serial dilution removes significant technical hands-on time. Additional significant time is removed from diluted sample addition, reagent addition as well as completion of test processing, reaction grading and recording of test results.

Conclusions: Utilizing test results from the automated method would require a transition for medical staff to better understand the change in titration results and implication of standard critical titers to patient care. Concurrent testing in tube tests and comparison of previous and current results along with automated testing with a transition period to all automated testing to demonstrate correlation of the two test methods is needed. Further clinical staff training will be required prior to full implementation of this change as well as potential changes to laboratory information system values during the transition. The use of the full automation that the ORTHO VISION Analyzer provides contributes to substantial cost savings by eliminating considerable labor-intensive activities.

Multi-Site Evaluation for Performance of a Platform Based Fully Automated Immunohematology (IH) Instrument

Casina TS, Fant-Holdaway PA, et. al.

TRANSFUSION 2016; Suppl.4: 56:145A; SP290

Objectives: Evaluation of an immunohematology testing system is necessary to show that the performance of the designed instrument demonstrates equivalence from a method-based perspective when compared to results of a predicate method or instrument. A next-generation larger capacity instrument was designed to fully automate immunohematology testing using the ID-MTS™ Gel Card test. A multi-site study was conducted to evaluate the performance of the ORTHO VISION Max Analyzer compared to the predicate, the ORTHO VISION® Analyzer. Consistency in reaction grade was evaluated across the instrument platform as this is critical to confidence in the results produced.

Study Design and Methods: Five laboratory study sites conducted testing. Method comparison testing was conducted on greater than 8000 samples acquired from the sites' routine workload to meet required sample criteria. Results were assessed at two levels, the microtube and interpretation level for direct agglutination tests and AHG tests. Discordant samples were repeated using the ID-MTS Gel Test manual method. Direct agglutination tests included: ABO (Forward and Reverse), Rh, Rh phenotype and immediate spin crossmatch were included in the direct agglutination while antibody detection, antibody identification, AHG crossmatch and the direct antiglobulin test (DAT) in the AHG tests. Data was assessed by comparison of interpreted tests to determine % concordance between the two instruments at the one-sided lower 95% confidence bound (LCB95). The acceptance criteria for concordance were ≥99.4% for direct agglutination tests and ≥98.0% for AHG tests.

Results: Direct agglutination testing was performed on >36,000 microtubes with 15,100 interpreted results. 15,081 interpreted results were concordant and 19 interpreted results were discordant. The system comparison demonstrated a concordance of 99.8% at an LCB95 interval for direct agglutination. DAT or IAT testing was performed on >17,000 microtubes resulting in 7,361 interpreted results. 7,344 interpreted results were concordant and 17 interpreted results were discordant. The system concordance was 98.7% at the LCB95 interval for AHG tests.

Conclusions: High concordance between the two systems was observed for both direct agglutination and AHG (DAT/IAT) for each site and across all sites combined. The multi-site evaluation demonstrated that the instrument developed, ORTHO VISION® Max Analyzer, showed equivalent performance versus the predicate system exceeding the LCB95 concordance acceptance criteria of ≥99.4% for direct agglutination tests and ≥98% for AHG tests in the intended use environment.

Evaluation of the Capability of a Fully Automated Immunohematology Testing Instrument to Perform Serial Dilutions

Casina TS, Witkowski R, Eckhardt A

Transfusion. 2015;55(Suppl. 3):133A;SP200

Objectives: This study evaluated the use of a fully automated immunohematology instrument (ORTHO VISION Analyzer) to prepare and test serial dilutions using direct agglutination to evaluate IgM isohemagglutinins (anti-A and anti-B) and the indirect antiglobulin test for IgG blood group antibodies. The results from fully automated dilution series were compared to manually prepared dilutions. Two fully automated dilution series on each sample were compared to demonstrate repeatability of the instrument.

Study Design and Methods: Selected antibody-positive samples containing anti-A, -B, (-A, B), -D, -K, -e, -E, -c, -Fy^{a} and -Fy^{b} were used in testing. Fifteen samples with isohemagglutinins (anti-A, -B) and 15 samples with alloantibodies were evaluated. One dilution series (doubling 1:1 to 1:1024 plus a saline control) was prepared manually and two on the ORTHO VISION Analyzer. Testing employed the ID-MTS Gel Test card; for IgM direct agglutination tests, the ID-MTS Gel Test (buffered) card and for IgG antibody, the ID-MTS Gel Test anit-IgG card were used. All three-dilution series were processed on the instrument. Concordance was judged based on the reactivity between the individual dilutions being within a ±1 reaction grade. A minimum 95% agreement at the one-sided lower 95% confidence bound interval (LCB95) was set as the acceptance criteria.

Results: For the ID-MTS Gel Test, 716 reactions were evaluated from both instrument and manual dilution testing and 358 in the instrument run to run comparisons. Of the 716 reactions, 100% of the results were within the ≤1+ criteria. This produced an LCB95% of 99.6%. Of the 358, instrument to instrument reactions compared, 357 were within the reaction criteria and achieved a 98.7% LCB95% concordance.

Conclusions: This study demonstrated that the ORTHO VISION Analyzer's serial dilution functionality supports the processing of antibody titration studies. The automated immunohematology test system showed equivalence to the manual serial dilution technique and demonstrated instrument repeatability using the ID-MTS Gel Test.

Evaluation of Usability of a New Immunohematology Instrument to Meet Regulatory Usability Validation Requirements

Casina TS, Warren K, Fanto-Holdaway PA

Transfusion. 2015;55(Suppl. 3):235A;AP59

Objectives: A multi-site/user usability study was performed on the ORTHO VISION Analyzer, an instrument that fully automates immunohematology (IH) testing. The overall objective of the study was to assure instrument design corresponded to identified user needs and intended system use in real practice conditions. The usability tests evaluated the potential of use errors. This study was conducted to meet the U.S. Food and Drug Administration 21 CFR Part 820 Quality System Regulation - Subpart C Design Controls, 820.30, which states that *"design validation shall ensure that devices conform to defined user needs and intended use and shall include testing of production under actual or simulated use condition."*

Study Design and Methods: An independent entity was contracted to design, execute and evaluate results, and provide the final output of the study. Usability test tasks were developed in conjunction with guidance provided in IEC 62366:2007 – Application of usability engineering to medical devices and the AAMI HE 75:2009 Human Factors Engineering Design of Medical Devices. Usability test evaluations were conducted at three laboratories and evaluated five tasks routinely performed in the use of the ORTHO VISION Analyzer. Each task was evaluated for failure due to a safety-related use error and failure due to a participant requiring test assistance to complete a task. A total of 15 lab professionals that met the intended user criteria were selected to perform the usability testing. Each tester received training on the instrument. Each participant was observed completing usability testing and a subjective post-test case interview was conducted.

Results: There were no failures due to a safety-related use error. Twelve failures occurred due to a need for task assistance. The task pass rate ranged from 73% to 100%. Interview feedback rated safety at ≥6.7 on a scale 1 (least safe) to 7 (most safe). Ease of use was rated ≥6.1 on a scale of 1 (difficult) to 7 (easy).

Conclusions: Using an independent testing entity and a multi-site/multi-user summative usability study, it was shown that the ORTHO VISION Analyzer exhibited a high degree of usability based on the results of testing. There were no safety-related use error failures observed and validation study was considered successful.

Multi-Site Evaluation of Performance of a New Fully Automated Immunohematology (IH) Instrument

Casina TS, Connors C, Warren K, Eckhardt A, Fanto-Holdaway PA, Grogan E, Sawyer B, Roughsedge B, Skrobach A
Transfusion. 2015;55(Suppl. 3):132A;SP199

Objectives: Evaluation of a new IH testing system is necessary to show that the performance of the new instrument demonstrates equivalence from a method-based perspective as compared to results of a predicate method or instrument. The ORTHO VISION Analyzer is an instrument designed to fully automate IH testing by using the ID-MTS Gel Test. A multi-site study was conducted to evaluate the performance of the ORTHO VISION Analyzer compared to the predicate, the ORTHO PROVUE Analyzer.

Study Design and Methods: Five laboratory study sites performed method comparison testing on a total of 8524 samples acquired from their routine workload to meet required sample criteria. Direct agglutination tests (ABO (Forward and Reverse), Rh, Rh phenotype and immediate-spin crossmatch (ISXM), and AHG-based tests (Abscr, AbID, AHG crossmatch and DAT)) were performed. Data from direct agglutination and AHG-DAT/IAT testing were assessed by comparison of interpreted tests to determine the percentage of concordance between the two instruments at the one-sided lower 95% confidence bound interval (LCB95). The acceptance criteria for concordance were ≥99.4% for direct agglutination tests and ≥98.0% for AHG tests.

Results: Direct agglutination: Testing was performed on 38,818 microtubes with 13,678 interpreted results, of which, 13,668 were concordant and 10 were discordant. The system comparison demonstrated a concordance of 99.9% at an LCB95. After discordant result investigation and adjustment, there were 13,671 interpreted results for direct agglutination testing, of which 13,668 were concordant and three were discordant. The adjusted system concordance was 99.9% at an LCB95 after adjustment for direct agglutination tests.

Antiglobulin Testing: DAT or IAT testing was performed on 15,673 microtubes, resulting in 6991 interpreted results, of which, 6908 were concordant and 83 were discordant. The system concordance was 98.6% at the LCB95 interval for AHG tests. After the discordant result investigation and adjustment, there were 6958 interpreted results, of which, 6904 were concordant and 54 were discordant. The adjusted system concordance was 99.0% at an LCB95 interval for AHG tests

Conclusions: High concordance between the two systems was observed for both direct agglutination and AHG testing for each site and across all sites combined. The multi-site evaluation demonstrated that the ORTHO VISION Analyzer system showed equivalent performance versus the predicate system, exceeding the LCB95 concordance acceptance criteria of ≥99.4% for direct agglutination tests and ≥98% for AHG tests in the intended use environment.

Method Comparison Between the ORTHO VISION® Analyzer and the ORTHO PROVUE® Analyzer

Colavecchia C, Patel S, Tanner L, Wendt A, Merkley L, Lin Y, Callum JL

Transfusion. 2015;55(Suppl. 3):131A;SP197

Objectives: Method comparison testing was executed to evaluate the performance of the ORTHO VISION Analyzer compared to the pre-existing ORTHO PROVUE Analyzer predicate using the ID-MTS Gel Test.

Study Design and Methods: Random samples as well as selected samples of certain disease states and various patient ages (including newborn and elderly) were tested for direct agglutination tests including ABO/RH/Rh phenotype and immediate spin crossmatch (ISXM) tests as well as antiglobulin tests including antibody detection, antibody identification, DAT and AHG crossmatch tests. Concordance of reaction grades was evaluated on a gel card column basis for each instrument as well as test interpretations compared. Use of the statistical analysis lower bound of the 95% confidence interval (LBCI) was applied to the column comparisons. Positive, negative and overall percent agreement at the microtube level was determined. Total percent agreement was established at the interpretation level.

Results: Microtube level agreement: Direct antigen tests of 3941 microtubes had a 100% agreement with an LBCI range between 98.9% to 99.7%. Reverse grouping of 1452 microtubes ranged between 99.7% to 100% agreement with an LBCI between 99.1% to 99.6%. The ISXM had 100% agreement with a 98.5% LBCI and the AHGXM had 99.5% agreement at a 97.4% at the LBCI. Antibody detection agreement was at 99.7% with a 99.4% LBCI while antibody identification was at a 98% agreement with a 96.8% LBCI. The DAT demonstrated a 99.3% agreement with a 96.8% LBCI. The antiglobulin testing evaluated 2885 microtubes.

Interpretation level agreement: The direct agglutination tests achieved a 100% concordance of 2425 test interpretations. Of the 1347 antiglobulin tests the concordance ranged between 98.3% to 99.5%. Of 59 antibody identifications, 58 were concordant which produced a 98.3% concordance.

Conclusions: A high level of concordance was achieved at both the microtube and interpretation levels of evaluation. This demonstrates equivalence between the ORTHO VISION Analyzer and the ORTHO PROVUE Analyzer.

Ortho Clinical Diagnostics Solutions for Transfusion Medicine

The demand for safe, timely transfusions is universal
People of all ages, ethnicities and backgrounds with a range of conditions — from accident and burn victims to heart surgery and organ transplant patients to those battling cancer or living with sickle cell disease — all rely on a safe and readily available blood and plasma supply.

The impact of blood donation is immense. One donation can potentially save three lives, and each year 4.5 million lives are saved by blood transfusions.

Today's transfusion medicine professionals face unprecedented challenges

Today's marketplace trends reflect demographic shifts, increasing testing volume, budgetary pressures, evolving regulatory requirements and skilled resource shortages — now more than ever, labs and donor testing centers are under constant pressure to provide uncompromised quality while managing costs and optimizing operational efficiencies.

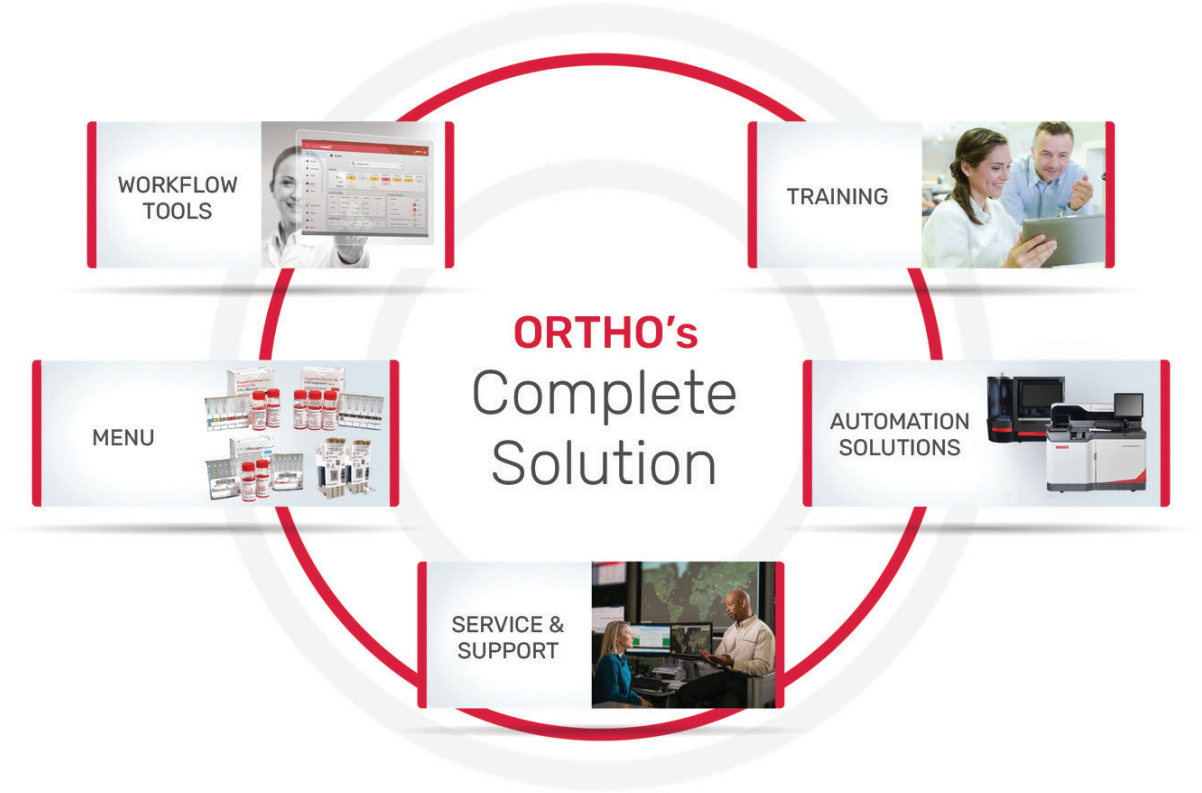
The power of partnership

As a global leader in transfusion medicine, *Ortho delivers more than tests — we deliver trust.* For over 80 years we have partnered with donor testing centers to provide accurate test results, efficient and reliable instruments, easy-to-use technology, and continuous collaboration and support to ensure you are achieving the most important measure of success: ***a trusted and safe blood and plasma supply.***

Plus, Ortho enables 24/7 access to service and support, training, education and industry trends with Ortho ON DEMAND. Live webcasts, on-demand videos, articles and case studies allow your team to learn from key opinion leaders and engage with colleagues.Ortho ON DEMAND offers content for professionals in both the transfusion medicine and clinical laboratory industries.

Your commitment to your patients is our inspiration …

Because Every Test Is A Life™



Ortho Clinical Diagnostics is a global leader of in vitro diagnostics dedicated to improving and saving lives through innovative laboratory testing and blood-typing solutions. We never stop innovating to offer streamlined, sustainable laboratory solutions that deliver fast, accurate, reliable test results to support exceptional patient care. **OrthoClinicalDiagnostics.com**

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