Photometric Rheology: Is This the New Gold Standard for ESR?

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Introduction

Erythrocyte sedimentation rate (ESR) is one of the most established and widely used laboratory tests in the world. This low cost, non-specific test measures the presence of inflammation in the body and can be used for screening or monitoring patients with subclinical, acute, and chronic inflammatory conditions.[1] Due to its low cost and non-specificity, ESR is frequently used as a general "sickness indicator." ESR results not only help determine the severity of inflammation, but also whether treatment is effective,[2] playing a key role in improving patient outcomes. ESR can be elevated due to infections, kidney, coronary and autoimmune diseases, vasculitis, and certain cancers.[2] ESR measurements are intended to be used by a clinician in conjunction with clinical examination, patient history, and other laboratory tests.

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ESR and C-reactive protein (CRP) are the most common tests for initial screening for inflammation.[3] The two tests, however, are not interchangeable. While CRP increases more significantly with acute conditions and bacterial as opposed to viral infections,[4] CRP has shorter acute phase timing and is not always associated with malignancy, chronic, and other less inflammatory conditions.[5] ESR measures cumulative inflammation and is less susceptible to short term fluctuations, so unlike CRP, ESR can be used to measure diffuse, low-grade, and subacute conditions as well as chronic conditions. While ESR clearly remains clinically valuable, it has traditionally been time-consuming and labor intensive for the lab to perform. The testing process requires precious hands-on time and is subject to a number of variables, and samples must be tested or refrigerated within a limited time frame of 4 hours. These stringent sample requirements challenge sample integrity as lab testing becomes more centralized and sample collection sites become more dispersed. Fortunately the development of new technology has led to an evolution for ESR testing.

ESR is not interchangeable with CRP. It can be complimentary over the time course of illness, providing additive information that is clinically valuable for both diagnosis and treatment.

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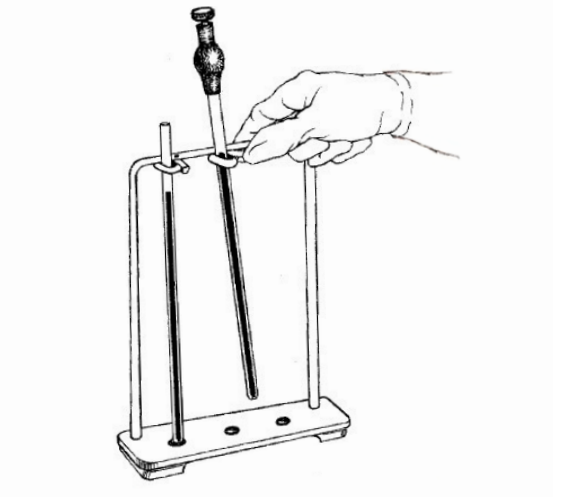
The evolution of ESR

The current reference method for ESR, the Westergren method, was developed in 1921 (Figure 1) and relies on full RBC sedimentation over the course of 60 minutes under controlled environmental conditions and remains virtually unchanged.[2]

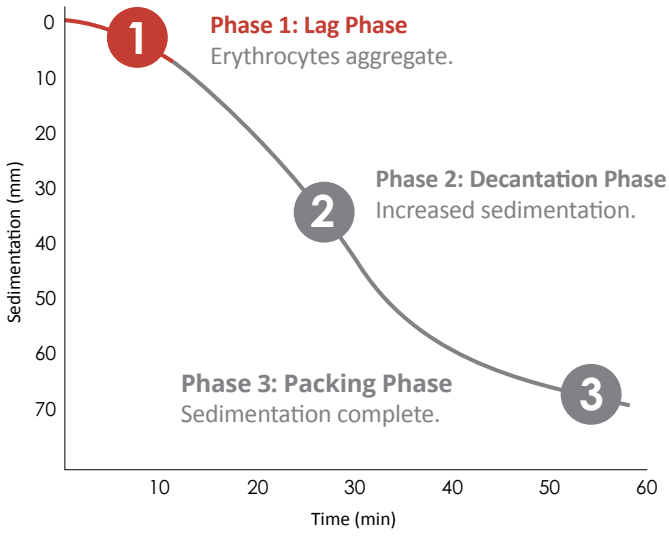
Figure 1. Placing the Westergren tube in the stand, c. 1921.



Modified Westergren methods measure sedimentation but can have a shorter assay time. Alternative ESR methods use completely different approaches.[6]

Photometric rheology is a unique new alternative ESR method that evaluates only red blood cell (RBC) aggregation, called rouleaux formation, which represents the first phase of the erythrocyte sedimentation process. (Figure 2). Because photometric rheology evaluates only aggregation, it is not as subjective to the many physical factors such as time, temperature, vibration, sample handling and transport, and operator variables which may impact both the Westergren, modified Westergren, and other methods that rely on RBC sedimentation (Figure 3).[2]

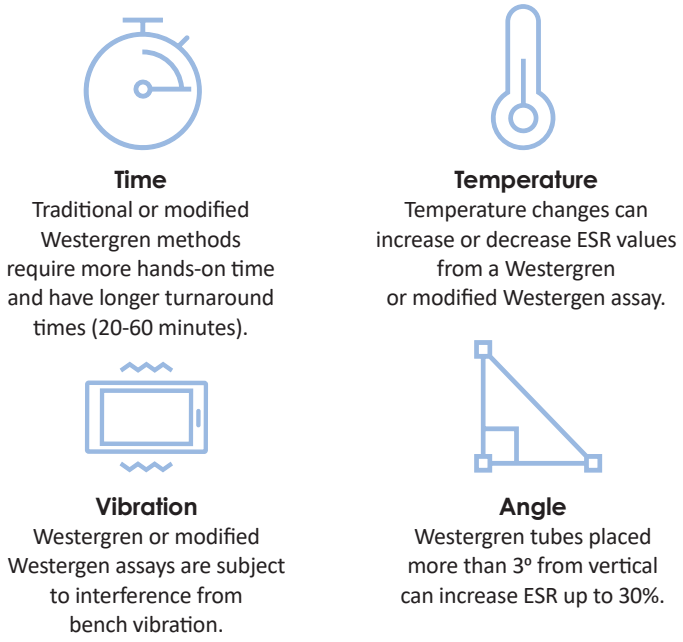
Figure 2. Photometric rheology measures the first phase of erythrocyte sedimentation.



The Clinical Laboratory Standards Institute (CLSI) recommends a maximum of 4 hours at room temperature or 24 hours refrigerated for the Westergren test to avoid sample degradation.[6] In contrast, photometric rheology-based ESR analyzers—which measure rouleaux formation rather than gravity-based RBC sedimentation—offer significantly extended sample stability. This greatly enhances result reliability, especially when immediate testing isn't feasible.

Improved stability also expands transport flexibility and reduces the need for redraws if courier delays occur or samples cannot be delivered or properly refrigerated within the 4-hour window—a common challenge for clinics that send samples to a central lab. Additionally, once samples reach the lab, non-STAT orders may be further delayed due to staffing shortages, creating yet another barrier to timely testing.

Figure 3. Physical limitations of the Westergren and modified Westergren test.



Some closed-system photometric rheology-based ESR analyers maintain room temperature stability up to 28 hours and refrigerated stability up to 48 hours, significantly improving sample transport options. These new generation analyzers also eliminate waste by not requiring disposable pipettes, reduce exposure to blood-borne pathogens, and operate with significantly less blood volume (100 µl), allowing more tests to be performed off of one sample tube.

Transforming ESR for today's busy labs

Many labs are facing significant staffing shortages. The overall vacancy rate of hematology lab staff is currently 16.6%.[7] Another 16.7% of hematology staff are expected to retire within 5 years.[7]

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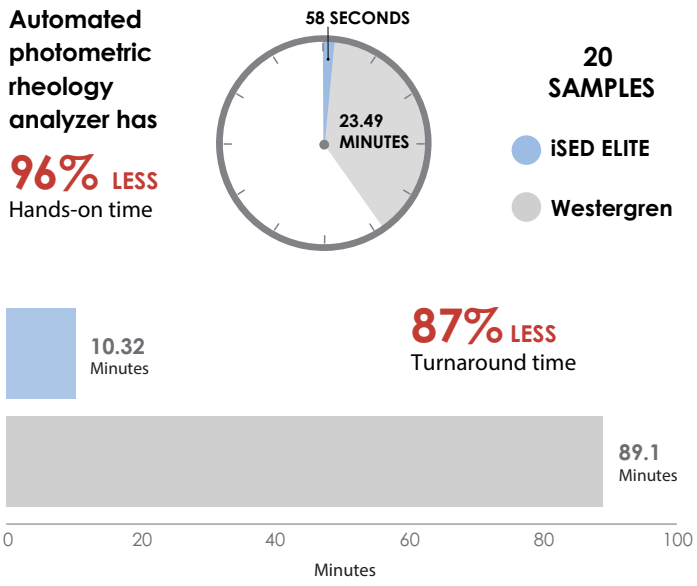
Developed in response to laboratory needs, automated ESR analyzers improve efficiency and reduce variability of ESR results commonly seen with the Westergren test. These analyzers utilize easily available EDTA tubes and are correlated to the Westergren reference method and engineered to reduce the hands-on time, turnaround time, and variability associated with the fully manual method.

Figure 4. iSED reduces hands-on and turnaround time.



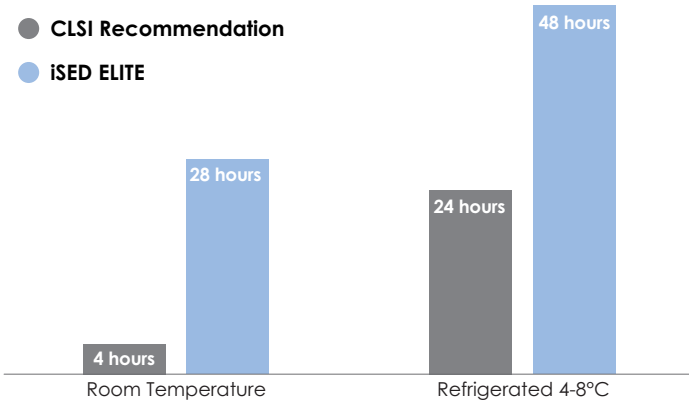
Automated photometric rheology eliminates variables in ESR measurements and reduces hands-on time to seconds. ALCOR® Scientific's iSED® ESR analyzers reduce hands-on time by 96% and turnaround time by 87% compared to traditional methods (Figure 4). They also have fewer training requirements than other moderate or high complexity tests, improve sample stability, reduce operator error and biohazard risk, and provide an automated fast workflow that improves conditions in labs with fewer staff. Bench footprints that fit both low and high-throughput needs, competitive cost, streamlined workflow, and less user hands-on time are additional advantages with automated photometric rheology systems.

> "Stability is particularly important for specimens collected late in the week or over the weekend, when many laboratories operate with reduced staffing, limited testing capabilities, and fewer courier runs to reference labs."
>
> — Richa Bedi, PhD, MHA, MS, MLT(ASCP)

Sample integrity and reliability

A 2025 third-party study by ALCOR Scientific evaluated the stability of EDTA-anticoagulated whole blood samples on the iSED line of photometric rheology ESR analyzers, and showed stability of ESR measurements on the platform up to 28 hours at room temperature and 48 hours refrigerated (Figure 5). These analyzers utilize micro flow cell technology to create a highly controlled environment to reduce variability from outside sources. Improved stability and reduction of environmental variability creates standardization of results between labs and operators across product lines for both low and high-throughput test locations. One of the most significant benefits of photometic rheology-based ESR analyers is improving sample stability; in fact, sample stability is 7x longer than Westergren or modified Westergren ESR methods

Figure 5. iSED vs. CLSI Westergren recommendation.



Conclusion

Automated photometric rheology ESR analyzers eliminate the drawbacks and limitations associated with traditional ESR testing, including stringent sample stability requirements, hands-on time, turnaround time, and subjectivity. They streamline workflow and minimize staffing issues. They are a vast improvement from traditional or modified ESR methods. Automated photometric rheology represents the evolution of ESR—delivering stable, reliable, real-world results.

iSED overcomes limitations and drawbacks of sedimentation-based ESR methods

1 Environmental variables

Eliminated with iSED: Testing is performed rapidly in a closed testing environment that is kept at a constant 37°C which limits exposure to environmental variables

2 Manual workflow

Eliminated with iSED: Fully automated testing procedure requires only seconds of tech time

3 Restrictive sample requirements

Eliminated with iSED: Samples are stable up to 28 hours at room temperature

4 Operator error and subjectivity

Eliminated with iSED: Fully automated process helps ensure accurate reproducible results regardless of operator

5 Biohazard risk

Eliminated with iSED: No uncapping of tubes or per-test disposables limits potential of exposure

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