A Field-Deployable Solution for Comprehensive Coagulation Assessment in Military Trauma Care: Acoustic Tweezing Coagulometry

Amit Bhayadia[1], Janeth C. Castano Jimenez[2], Manik Dautta[1], Nathan J. Alves[2,3], Nithya Kasireddy[1*]

[1]Levisonics Inc, Fishers, IN | [2]Indiana University School of Medicine, Indianapolis, IN | [3]Purdue University, West Lafayette, IN

Motivation

- Hemorrhage complicated by trauma-induced coagulopathy remains a major cause of preventable death in combat casualties.
- Coagulation status can shift rapidly after injury, resuscitation, transfusion, hypothermia, and shock.
- Delayed or incomplete characterization of clotting profile can limit timely and targeted hemostatic treatment (blood products, drugs).
- Far-forward care therefore needs rapid, actionable coagulation information near the point of injury.
- PT/INR and aPTT detect clot initiation only, not clot development or mechanical strength.
- TEG/ROTEM add clotting rate and strength data but are largely confined to hospital-level settings, requiring controlled conditions and trained personnel.
- Currently available tests also need larger blood volumes, often several draws across multiple tests.
- Modern warfare trends toward longer evacuation times to Role 3/4 care, pushing more responsibility onto Role 1/2, where the right tools are often unavailable.

Technology: Acoustic Tweezing Coagulometry

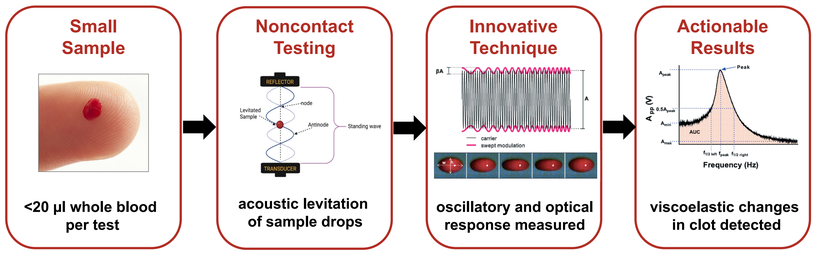


Figure 1. Acoustic tweezing coagulometry technology summary

- Acoustic tweezing coagulometry (ATC) offers a field deployable comprehensive coagulation assessment solution for Role 1/2.
- This patented technology uses sound waves to levitate whole blood drop and assess a complete picture of blood coagulation.
- Tracks changes in location and shape of the drop during a test.
- Measures the same time-dependent viscoelastic and optical properties of the blood during clotting that standard tests measure, but with a significantly smaller sample.
- Captures early (liquid blood), intermediate (semi-solid blood) and late stages (solid blood) of clotting in one test.
- Outputs 12+ parameters that inform about the clot initiation, rate and strength as well as fibrin kinetics and crosslinking, including unique measures like Factor XIII activity, not measured by other viscoelastic tests.
- Delivers a more complete, holistic clot profile than current tests.

Outputs: Comprehensive Coagulation Profile

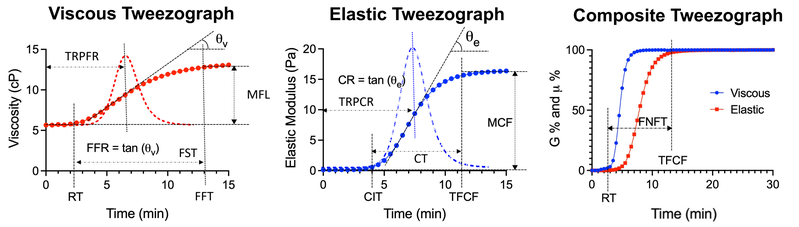


Figure 2. ATC output tweezographs and coagulation parameters

Reaction Time (RT)
Clot Initiation Time (CIT)
Clotting Time (CT)
Fibrin Stage Time (FST)
Fibrin Formation Time (FFT)

Clotting Rate (CR)
Fibrin Formation Rate (FFR)
Maximum Fibrin Level (MFL)
Maximum Clot Firmness (MCF)

Time for Firm Clot Formation (TFCF)
Time to reach peak clotting rate (TRPCR)
Time to reach peak fibrin rate (TRPFR)
Fibrin Network Formation Time (FNFT)

ATC offers the advantages of both plasma-based lab testing and point-of-care viscoelastic testing in a single test at point-of-injury.

Trauma Patient Study

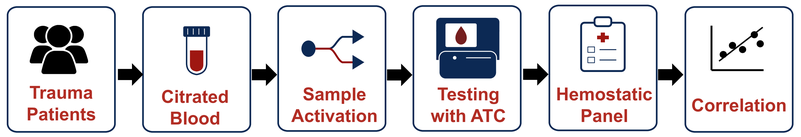
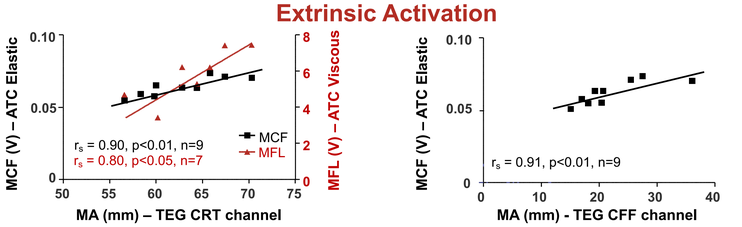


Figure 3. Study overview.

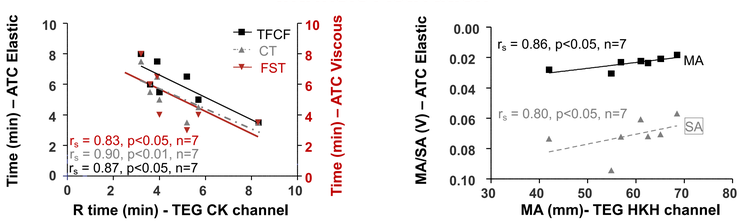
- This study was conducted in collaboration with Indiana University at IU Health Methodist Hospital under IRB Protocol #24904 with informed consent waiver obtained to enroll Level 1/2 trauma patients.
- Citrated whole-blood samples were activated using custom recipes via intrinsic and extrinsic pathways and tested using ATC prototype device within 30 min of collection.
- ATC parameters were correlated with the standard of care hemostatic panels and TEG when available.

Results

Extrinsic Activation



Intrinsic Activation



Discussion and Next Steps

- In this study, samples were activated via intrinsic and extrinsic pathways and correlated strongly with pathway-matched TEG channels and, more broadly, with additional channels.
- Standard of care lab and TEG panels varied by clinical need, not every patient received the same channels or had complete TEG outputs, which limited our correlation analysis.
- A larger, more complete dataset is needed to strengthen interpretation against plasma-based assays and platelet function specifically, not just timing and strength parameters.
- These results represent interim analysis with ongoing enrollment. Correlations are exploratory and will be re-evaluated as matched data accrue.

Our Minimum Viable Prototype

- Minimal Sample
- Role 1/2 relevant
- User friendly
- Portable and field deployable
- TRL 4 – 5
- Comprehensive Research Tool

References

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Acknowledgements

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Disclosures

- ATC technology is protected by multiple patents.
- Levisonics-affiliated authors are employees and may hold equity.
- Levisonics Inc develops ATC-based devices.
- Current prototypes are at TRL 4 – 5, validated in lab and clinical settings on various patient populations.
- ATC development is advancing toward commercial deployment for use in both civilian and military applications.
- This poster is submitted exclusively for MHSRS 2026; not for distribution without permission.

Contact Information

Contact Us:
Nithya Kasireddy, PhD
nkasireddy@levisonics.com
www.levisonics.com