# Like Trying To Find a Needle in a Blood Sac: Novel Hemostatic Gelatin Microneedle Adhesive (Gel MNA) Polymerized With Commercial Coagulation Agents Achieves Accessible Hemorrhage Treatment

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Hemorrhage, excessive loss of blood that is expressed through eventual shock and death, is one of the leading killers worldwide. Current methods of preventing hemorrhage have many side effects and expend resources many do not have. By using a pre-existing gelatin microneedle array model with the polymerization of zeolite, fibrinogen, and methacrylic anhydride found in other commercial gauzes, the experimenter engineered a new prototype and tested the hypothesis that an engineered gelatin microneedle adhesives (Gel MNA) will lead to more effective clots. The gelatin microneedles prototypes were first engineered using porcine gelatin and additional biocompatible coagulation agents and tested by using drawn blood in well plate assays testing the prototypes against commercial products. Plates were tested for blood sorption time, clot mass, and clot perfusion and lysis. Image J was used to help analyze data. A t-test was used to process data. Compared to the non-needles and pure blood and plasma groups, Gel MNA prototypes with methacrylic anhydride, zeolite, and fibrinogen separately saw clot time reduced by nearly 40% on average. On bloodsorption, the percentage absorbed significantly increased with microneedles and added polymerized chemicals. Perfusion in samples with methacrylic anhydride increased with fibrinogen, yet clot mass nearly doubled, and with zeolite perfusion increased, clot mass increased likewise. This study has begun to show the potential polymerized, "hard" gel can have on hemorrhage control and in different clinical settings. The low-price, accessible, and highly vascular clots formed thus far in various studies and runs have a large potential to transform how we view blood loss control. Future tests will clarify blood clot adhesion and lysis.

**Awards Won:**
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,