Refining a Novel Device to Decrease the Risk of Vesicovaginal and Rectovaginal Fistulae during Labor

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In developing areas where professional medical care is scarce, the labor complications that result in the development of obstetric fistulae are common and the effects devastating, with over two million women currently suffering from severe incontinence, shame, and terrible pain. The purpose of this experiment was to refine and redesign a cost-effective and portable device to decrease the risk of vesicovaginal and rectovaginal fistulae during childbirth. From the use of an improved precise, self-built CAD and FEA model of female pelvic anatomy from anonymized CT scan data and both a mechanical simulation and computational fluid dynamics simulation program, different designs and design materials were tested, yielding a final device design. Then, the stress-distributing properties as well as the amount of strain experienced of the final design was compared with that of using no device at all. For the revised prototype, the mean stress at the key point showed a percent difference of almost 200% for all three tests, and each t-test performed for each test yielded a p-value much less than the declared alpha value of 0.05, showing that the device significantly decreases the amount of stress at points where fistulae commonly occur. A more complex model with isolated contact pairs and mathematical modeling, simulation, and inclusion of fluid factors contributed to the improved accuracy of the results and design. However, this design and the model will be further optimized with daily redesigning and simulation.

Awards Won:
U.S. Agency for International Development: USAID Global Development Innovation First Place Award of $3000