Engineering bouncing babies, one at a time

March 2 2009

As hopeful moms-to-be learn, there are important considerations to the successful implantation of a fertilized human egg. A calm environment, regular hormonal injections and the timing of the implantation can all affect the outcome of an in-vitro procedure.

Now a Tel Aviv University researcher is suggesting that prospective parents and their obstetricians also look at the role that gravity and other biomechanical processes play in its success. New studies by Prof. David Elad from TAU's Department of Biomedical Engineering could help desperate couples give birth to healthy single babies - and avoid the risk of multiple births at the same time.

"I am specifically studying how the uterus contracts before the embryo implants itself onto the uterine wall," he says. These contractions play a vital role in keeping the embryo in the uterus, and knowledge of its mechanics can indicate the optimal time and site for implantation. Physical positioning of the woman and the shape and size of her uterus also affect the results of IVF implantation, Prof. Elad says.

His recent publication in the journal *Fertility and Sterility* suggests methods to enhance the success rate of fertility treatments.

The Gravity of the Situation

"We are all subject to the Earth's gravity forces, and all biological process must also obey Newton's basic laws of physics," says Prof. Elad, who has been studying the biomechanical engineering of pregnancy for

over 15 years. "Uterine contractions push the fluid inside a woman's womb in a peristaltic fashion, which helps sperm reach the ovum in the fallopian tube. And after fertilization, this same peristalsis propels the embryo to its implantation site in the uterine wall. It's a fluid mechanics issue.

"By thinking about these biomechanical processes during IVF treatments, we can help physicians, and prospective parents, see better outcomes," he says. The chance of finding an optimal uterine position could be improved through Prof. Elad's recommendations.

"There is no such thing as a standard uterus," Prof. Elad adds. "Our research offers best practices for women of all shapes and sizes."

Avoiding Multiple Birth Dangers

To increase the chances of a successful IVF implantation, women can opt for three or more viable embryos to be implanted in the womb during one cycle. Many, emotionally and financially exhausted, take this chance even if it means an embryo will need to be sacrificed to ensure the health of another. Prof. Elad's research may spare women from having to make this difficult ethical decision.

"Besides recent reports that IVF babies are slightly more prone to genetic diseases, there is a general notion that when there is more than one embryo in the uterus, all the fetuses are subjected to risks of mild and sometimes severe medical problems in the future," says Prof. Elad. "Parents naturally want to avoid this circumstance."

New Tools for IVF Specialists

Through advanced bioengineering research, Prof. Elad, who is currently

a visiting professor at New York's Columbia University, is continuing to provide "stimulating evidence" to the IVF medical community. He is working on a computer simulation program on embryo transport in the uterus, in both natural conception or after IVF procedures, to model how and when artificially inseminated embryos should be implanted in the uterus.

Source: American Friends of Tel Aviv University