Gestational Diabetes Affects Fetal Stem Cells and Reduces Therapeutic Potential

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Evidence from a recent study shows that human umbilical cord mesenchymal stromal cells (hUC-MSCs), when isolated from women with [**gestational diabetes**](http://diabetesnewsjournal.com/tag/gestational-diabetes/), display premature aging, poorer cell growth, and altered metabolic function. The study is entitled, “[Umbilical Cord Mesenchymal Stromal Cells Affected by Gestational Diabetes Mellitus Display Premature Aging and Mitochondrial Dysfunction](http://online.liebertpub.com/doi/full/10.1089/scd.2014.0349),” and is published in the current issue of the journal [*Stem Cells and Development*](http://online.liebertpub.com/doi/full/10.1089/scd.2014.0349).

Human umbilical cord mesenchymal stromal cells of Wharton’s jelly origin undergo adipogenic, osteogenic, and chondrogenic differentiation in vitro. Evidence from recent studies shows that these cells have the potential to be used in the development of therapeutics in human disease models of various conditions. However, the biological effects of major pregnancy complications on the cellular properties of hUC-MSCs remain poorly understood.

To help find answers to this question, **Jene Choi**, PhD from the Department of Pathology Asian Medical Center, University of Ulsan College of Medicine in Korea, and colleagues compared the basic properties of hUC-MSCs obtained from gestational diabetes mellitus (GDM) patients (GDM-UC-MSCs) with those obtained from normal pregnant women (N-UC-MSCs). Choi’s team examined cell growth, cellular senescence, and mitochondrial gene expression (MSC) to assess metabolic activity.

Data analysis revealed that, when compared to N-UC-MSCs, GDM-UC-MSCs revealed decreased cell growth, earlier cellular senescence, and lower osteogenic and adipogenic differentiation potentials. The results also revealed that the GDM-UC-MSCs exhibited little mitochondrial activity and significantly reduced expression of specific genes that regulate mitochondrial function.

The researchers concluded that maternal metabolic imbalance during gestation affects the natural properties of fetal cells. These findings also highlight the significance of the need to adequately assess pregnant women for any other health conditions that may pose a threat to the unborn child’s developing cells.

“We are only just beginning to scratch the surface of understanding how environmental and gestational stressors of all kinds affect [stem cell](http://diabetesnewsjournal.com/tag/stem-cell/) populations,” said Editor-in-Chief Graham C. Parker, PhD, The Carman and Ann Adams Department of Pediatrics, Wayne State University School of Medicine, Detroit, MI, in a recent [news release](http://www.eurekalert.org/pub_releases/2015-01/mali-dgd012015.php), “The work described offers a non-invasive assay to help determine risk of developmental clinical vulnerability.”

In other developments in diabetes, [a temporary tattoo innovatively designed to extract and measure the levels of glucose in the fluid stored in between skin cells has been tested by nanoengineers at the University of California, San Diego.](http://diabetesnewsjournal.com/2015/02/03/temporary-tattoo-can-soon-monitor-glucose-levels-in-diabetics/) This is the first-ever example of the easy-to-wear and flexible device, and could be a huge step towards noninvasive glucose testing for patients living with diabetes.

# Temporary Tattoo Can Soon Monitor Glucose Levels In Diabetics

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A temporary tattoo innovatively designed to extract and measure the levels of glucose in the fluid stored in between skin cells has been tested by nanoengineers at the [University of California](http://www.universityofcalifornia.edu/), San Diego. This is the first-ever example of the easy-to-wear and flexible device, and could be a huge step towards noninvasive glucose testing for patients living with [**diabetes**](http://diabetesnewsjournal.com/tag/diabetes/). This study was published in the journal [*Analytical Chemistry*](http://pubs.acs.org/journal/ancham) and is titled, [“Tattoo-Based Noninvasive Glucose Monitoring: A Proof-of-Concept Study.”](http://pubs.acs.org/doi/abs/10.1021/ac504300n)

The device was developed and then tested by **Amay Bandodkar**, a graduate student, and colleagues at the NanoEngineering Department and the Center for Wearable Sensors at the Jacobs School of Engineering at UC San Diego. According to Bandodkar, this sort of sensor could also be used for other purposes such as delivering medicines through the skin or detecting other important metabolites existent in the body.

As of today, the tattoo still cannot provide accurate numerical measures that could allow patients to [monitor and manage their own glucose levels](http://diabetesnewsjournal.com/tag/continuous-glucose-monitoring/); however, this is being advanced by computer and electrical engineers at the Center for Wearable Sensors. “The readout instrument will also eventually have Bluetooth capabilities to send this information directly to the patient’s doctor in real-time or store data in the cloud,” said Bandodkar.

Further, researchers are also interested in making the tattoo last for longer periods without raising its overall costs. “Presently the tattoo sensor can easily survive for a day. These are extremely inexpensive–a few cents–and hence can be replaced without much financial burden on the patient,” he [said](http://www.eurekalert.org/pub_releases/2015-01/uoc--tto011415.php).

This approach would allow researchers to collect data that would prove essential for research, could be crucial for more effective prevention and, at the same time, offers a more comfortable procedure for diabetic patients monitor their condition. The device works with a really mild electrical current that is discharged into the skin for about 10 minutes forcing sodium ions existing in the fluid between skin cells to move toward the tattoo’s electrodes; this allows to calculate the overall levels of glucose.

“The concentration of glucose extracted by the non-invasive tattoo device is almost hundred times lower than the corresponding level in the human blood. Thus we had to develop a highly sensitive glucose sensor that could detect such low levels of glucose with high selectivity,” Bandodkar [noted](http://www.eurekalert.org/pub_releases/2015-01/uoc--tto011415.php).