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**Plenary Lecture**

# MEDICAL DEVICE-RELATED PRESSURE ULCERS: WHERE BIOMECHANICS SHOULD COME TO THE RESCUE

*Amit Gefen*

**Tel Aviv University, Israel**
*gefen@eng.tau.ac.il*

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**Summary:** We have developed multiple physical (phantom) and computational (finite element, FE) three-dimensional anatomical model systems to investigate commonly encountered conditions and scenarios at which medical device-related pressure ulcers (injuries) may occur. Medical device-related pressure ulcers (MDRPUs) are injuries associated with use of devices and equipment applied for diagnostic or therapeutic purposes, where the injury has the same configuration as the applied device. In intensive care units (ICUs), MDRPUs caused by endotracheal and nasogastric tubes are common, both in adult and in pediatric settings. Studying the root causes of MDRPUs and effective means to mitigate their risk will lead to improved quality of life of patients and considerable saving of costs which are otherwise invested in treatment. Development of experimental and computational biomechanical models is essential for creating laboratory standards for testing the safety of medical devices which are in contact with the surface of the body. We have developed experimental head phantom systems equipped with force sensors as well as FE models of adult and pediatric patient heads to simulate strains and stresses in head soft tissues during interactions with devices, particularly tubing, electrodes and head supports. Based on our findings, we feel that the design of medical devices and equipment used in ICUs should be re-visited, since currently, there appears to be no attention to the safety of use with regard to the pressure ulcer risk. Much can be done concerning the design of device structures, selection of materials and integration of mechanisms that minimize the risk, e.g. of misplacement under the body, so that tubes, wires, electrodes and other equipment can be made safer, even if forgotten or misplaced between the patient and support surface. For example, selection of more adequate, softer materials and devices, e.g. development of soft electrodes made of conducting textiles and similar ideas can vastly minimize the occurrence of MDRPUs. These examples will be discussed in the talk, based on data from our recent experiments and FE simulations of scenarios where there is high risk for MDRPUs.