

A SURGEON'S PERSPECTIVE ON MEMS FOR SURGERY

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ABSTRACT

Surgery has changed a great deal in the past decade. The change is denoted by the term "minimally invasive surgery". The essence of minimally invasive surgery is the use of technology to enable the surgeon to perform his therapeutic tasks in ways which are less physically and physiologically harmful to the patient. At present, the technologies principally in use are imaging technologies (chiefly video and x-ray) coupled with some very basic mechanical devices which allow the surgeon to manipulate organs in various body cavities without opening the body cavity. There is still a long way to go in achieving the full potential of minimally invasive surgery. MEMS technologies can definitely play a role here. I envision the main use for MEMS technology to be in allowing us to design surgical instruments which incorporate various kinds of sensors. Placing micro sensors on the instruments will restore for the surgeon the tactile immediacy of operating with his hands directly on the tissue, instead of through the intermediary of an insensitive and awkward mechanical device. The sensor types which will probably be useful for surgical instruments fall into two overall categories: the first category is sensors which give the surgeon some force feedback as he goes about the job of placing various types of tissue fasteners (staples or sutures). Many surgical complications arise because there is insufficient or inaccurate force feedback to regulate the closing pressure of staples or sutures. Excessive closing pressures can result in tissue necrosis while insufficient pressures may result in leakage through the staple/suture line. The other category of sensors would be various chemo sensors, which can detect the pH, oxygen and carbon dioxide levels in tissue, as well as other chemical entities of clinical importance such as lactic acid.