Description for the general public

Research problem justification

The project stems from changing epidemiologic and demographic situation of Polish society. In the coming years due to higher morbidity from diseases of affluence (e.g. diabetes, cancer, atherosclerosis), their complication rate will also have an increasing trend. Especially acute complications are chronic wounds of the skin like bedsores, wide burnings or ulcerations. Currently, their healing monitoring is in vast cases performed almost without any measurement device providing objective results. The only measurement method utilizes a ruler in order to obtain the diameter of the wound, sometimes accompanied by making of photographic documentation. In the case of chronic wound there is an adjacent area covered in healthy skin despite presence of damaged tissues underneath. The knowledge about the degree of the damage would allow early complications to be detected and treated.

Research project objectives

The aim of the project is to develop a methodology for comprehensive monitoring of chronic wound healing. To do so, a set of various imaging modalities will be utilized: color photography, stereovision, thermography, Time-of-Flight depth perception and high frequency ultrasonography. Hybrid model, obtained from a fusion of abovementioned modalities, its applicability for depth of the wound assessment as well as its extent (usually undetectable under healthy skin) will be tested. The developed computer aided diagnosis system will enable a 3D model of the wound to be created and visualized. Novel approach within the project is the application of high frequency ultrasound (micro-ultrasonography) that permits skin layers with high precision to be determined.

Research agenda

Four research tasks are planned:

The first, called “Development of methodology for multimodal chronic wound image acquisition”, is devoted to the development of calibration methods for the imaging modalities used, i.e. color photographic camera, thermographic camera and ultrasound. A test and measurement stand will ensure a single common coordinate reference frame for every imaging modality as well as the repeatability of wound placement in successive data acquisition sessions.

In the second task, entitled “Development of a multimodal image fusion technique”, a 3D surface model of the wound is to be generated basing on Time-of-Flight and/or stereographic cameras. Then, image fusion employing photography and thermography as well as ultrasound will be superimposed over the surface model displaying the insight of the wound. Finally, a visualization of the wound will be possible together with estimation of its the volume including the internal regions underneath healthy skin.

The third task is called “Development of chronic wound monitoring technique”. Monitoring will be concentrated on measurable parameters derived from the model (region, localization, shape, temperature) during the healing process. A method for the total wound area and the temperature related area will be developed. 3D models obtained from successive acquisition sessions will be subjected to a comparative analysis.

The final, fourth, task is “Development of visualization system and clinical verification method”. A clear and coherent graphical user interface will simplify the perception of the wound condition. The software will also permit a set of key features derived from the model to be identified as the most adequate for the quantitative description of the healing process.