Anchoring and housing system for an esophageal ECG recorder

Joint Master's Program in Biomedical Engineering, University of Bern and Bern University of Applied Sciences
Fachgebiet: Biomedical Engineering
Betreuer: Dr. Andreas Häberlin, Thomas Niederhauser
Experten: Dr. Reto Luginbühl, Dr. Rolf Vogel

Heart diseases are in many countries, besides cancer, the second major death reason. To diagnose specific heart diseases like heart rhythm disorders (arrhythmias), electrocardiography (ECG) is used. The goal of this masterthesis was to develope an anchoring and housing system for an esophageal ECG recorder.

Introduction

Paroxysmal arrhythmias in particular require long-term ECGs to detect rare events. The signal quality of the todays used long-term ECGs is low and the electrodes, which are stuck to the patient's chest or limbs, can lead to skin irritations. As an alternative, the esophageal ECG provides a method to avoid these inconveniences.
The aim of this master thesis was to develop a housing which allows to stow all the necessary electronic components of the esophageal ECG recorder in the nose. To prevent the housing from swallowing or shift outwards, it has to be fixated. It is important to ensure that the fixation doesn›t harm the patient nor lead to complications.

Materials and Methods

To evaluate the prototypes for the anchoring and housing system, a 3D model of the human nose has been developed.

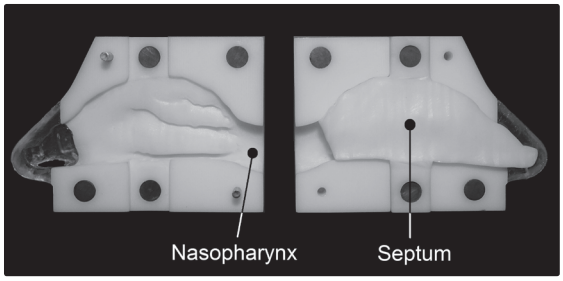

Fig. 1: 3D model of an average human nose (used for the evaluation of the anchoring and housing system)

Different variants have been developed for the housing and its fixation. These concepts were systematically evaluated to choose the concept which best reaches the set requirements. With tests on the nose model and various meetings with ENT specialists, the decision was made to produce a housing which will be placed behind the septum in the nasopharynx.

The required energy for the electronics is provided by zinc-air batteries. Since they are placed behind the septum, they must be sealed against water. Therefore a method was developed to seal the batteries against water and allow the oxygen to access them. This was done by a hydrophobic membrane.

Results

The housing behind the septum is fixated by a thread which surrounds the nasal septum and is knotted over the nose bridge. To guide the implantation of the system, an insertion device has been developed. This device is used for the insertion and removal of the housing as well as for the insertion of the fixation thread.

Discussion

Tests with the hydrophobic membrane proved, that it is possible to seal the batteries against water, while having normal ambient conditions.

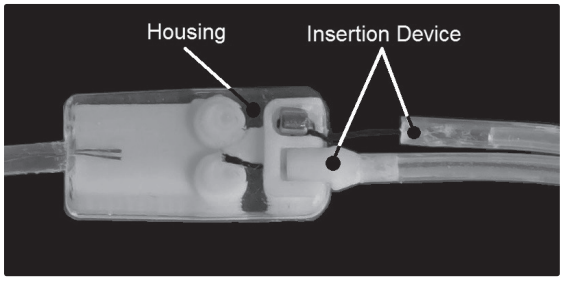

Fig. 2: Anchoring and housing system with insertion device

Tests with the nose model confirmed the method of inserting the developed housing behind the septum. However, the system volume needs to be reduced. For a reliable insertion of the anchoring and housing system, further improvements towards the miniaturization of the device are required.

Angelo Blank