

Šviesolaidinės ATR IR spektroskopijos taikymas kasos vėžinių audinių tyrimui

Application of Fiber ATR IR Spectroscopy for Cancerous Pancreas Tissue Examination

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Pancreatic cancer has one of the lowest survival rates [1] and usually it tends to spread to surrounding tissues, liver, lymph nodes, lungs or other more distant organs. The treatment of pancreatic cancer involves surgical operation, chemotherapy and radiotherapy. If the tumor is resectable, the success of treatment depends on the ability to determine its exact boundaries. It is necessary to remove all the cancerous cells in order to avoid the relapse of the malignancy and to prolong life of the patient. On the other hand, it is important to leave as much as possible of the non-damaged tissue in order to save vital functions of the organ. Therefore, a directly usable method for the identification of tumor borders during the surgery is needed.

A variety of methods of vibrational spectroscopy are being applied for examination of biological tissues in recent decades [2]. First attempts in such studies was to study thin slice of the tissue placed in the sample chamber of the spectroscopic instrument. The sample should be specially prepared, the thickness of the sample should be appropriate for the measurements. While using standard ATR (attenuated total reflection) technique, a thickness of the sample is not limited but a piece of tissue also should be cut and transferred to the device.

In case of application of spectroscopic methods in clinical diagnostics, it is important to examine the sample in its native conditions, at the shortest time and applying minimal sample pre-processing. In this study, fiber optics was applied for the spectroscopic measurements. ATR crystal of the probe enables measurements of the tissue without any specific preparation; changeable tips of the probe provide the possibility to sterilize them. Measurements could be performed *in situ* or *in vivo* conditions in a few minutes that is important for the use in the operating room during the surgery.

In this study cases of 27 patients with pancreas pathology (pancreatic ductal adenocarcinoma – PDAC, neuroendocrine carcinoma, metastatic tumors and pancreatitis) were investigated. Measurements were performed for the tissue removed during the surgery. ATR IR absorption spectra of normal and PDAC (the most common pancreatic cancer) tissue are represented in the Fig. 1. The increased intensity of the spectral bands located at 1034, 1207 and 1339 cm^{-1} is observed in the spectra of cancerous tissue. The increased intensity of these spectral bands of the tumorous tissue indicates altered levels of collagen in the tissue. The amount of

collagen in PDAC tissue increases due to the desmoplasia which is a common feature of PDAC tumors. During this desmoplastic reaction fibroblast cells secrete more fibrous proteins (collagen) to the extracellular matrix of the tissue. The established spectral markers of tumorous pancreatic tissue indicate that applied technique is appropriate for identification of malignant pancreatic tissue.

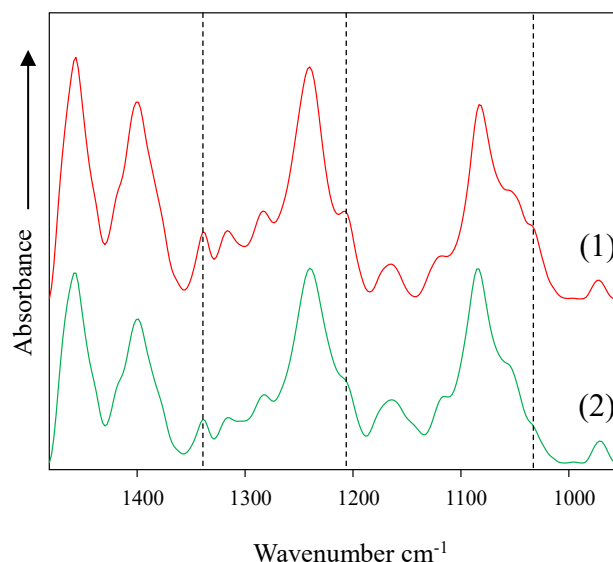


Fig. 1. Averaged ATR IR absorption spectra of PDAC (1) and normal (2) pancreas tissue of 16 patients

Key words: Pancreatic cancer, ATR IR spectroscopy, ATR fiber probe

Literature

- [1] M. Orth, P. Metzger, S. Gerum, et al., *Radiat Oncol* **14**, 141 (2019).
- [2] G. Bellisola, C. Sorio, *Am J Cancer Res* **2**, 1 (2012).