FTIR as a method for diagnosis of thyroid disorders

Felipe Guimarães Albero, Denise Maria Zezell
Centro de Lasers e Aplicações, IPEN - CNEN/ SP, São Paulo, Brasil

Etelvino José Henriques Bechara
Instituto de Química, USP and UNIFESP/Diadema, São Paulo, Brasil

Orlando Parise Júnior
Hospital Sírio Libanês, São Paulo , Brasil

Thyroid nodules are a common disorder, being the lifetime risk of developing a clinically significant thyroid nodule 10% or higher. Although the fine needle aspiration biopsy (FNAB) is a highly accurate method for thyroid tumors diagnosis the discrimination between benign and malignant papillary neoplasm is currently not possible, leading to a surgical intervention due to the risk of carcinoma. In this case, there is a lack of biological marker able to identify malignant transformation. The aim of this pilot study is to verify infrared absorption differences on FNAB of thyroid carcinomas and goiters.

Samples of FNAB of thyroid nodules and corresponding normal surrounding gland, suspended in 2 ml of saline solution at 0,9%, were surgically collected and frozen in liquid nitrogen. A drop of 5 μL of the cell suspension dried was placed on one infrared transparent CaF_2 window. The FNAB samples were measured on a Nicolet 6700 FT-IR spectrometer, calibrated it between 525 and 4000 cm^{-1}, at a nominal resolution of 4 cm^{-1} wich 120 scans. The spectra were corrected by the baseline and normalized by intensity in order to minimize variations of sample homogeneity. Then, these spectra were converted into second derivatives using the Savitzk-Golay algorithm with a 9 points window. The Ward's minimum variance algorithm and Euclidean distances among the points were used of clusters. For each sample of FNAB used in the study, the cytological diagnosis was determined by a trained pathologist/cytologist using Giemsa staining.

We evaluated 40 samples, including 19 adenomatous goites and 13 papillary carcinoma, 2 Graves disease, 2 follicular adenoma and 4 Hashimoto thyroiditis. Some thyroid aspirates showed a more complex spectral pattern. Generally, patients are diagnosed with colloid goiter when the FNAB contains many blood cells and large amount of thyroglobulin, hat it represents the bands of 1545 and 1655 cm^{-1}. Also bands in regions between 1409, 1412, 1414, 1578 and 1579 cm^{-1} were found, indicating possible presence of sugar, DNA, citric acid or metabolic products.

Our preliminary results suggest that FT-IR spectroscopy may be useful differenciate thyroid carcinomas from goiters. A further evaluation is necessary on FNAB of papillary thyroid pattern, as well as the sample numbers should be increased.