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Extended Abstract

Raman Spectroscopy as a Diagnostic Tool Applied for Tissue Pathologies to Support Histological Analysis †

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Raman spectroscopy (RS) is a non-invasive optical tool to obtain molecular fingerprints of biological tissues. As an analytical technique, RS is able to provide biochemical information with high specificity and without labelling. Recent technological advancements led to the availability on the market of user-friendly Raman imaging microscope instruments, providing coupled morphological and spectral analysis of large tissue areas. In this way, tissues can be discriminated not only based on their morphological features, sometimes not well defined and uncertain, but also based on their biochemical composition. Biochemical information gains importance in the cases, when it is necessary to discriminate between cancerous and non-cancerous pathologies and, especially, for pre-cancerous tissue earlier understanding and prevention.

Nowadays, in order to get a decision on tissue diagnosis, gold standard histopathological evaluation and marker identification are supported by imaging techniques, such as MRI, computed tomography, x-ray, ultrasound, colonoscopy and endoscopy, etc. However, these imaging techniques do not provide biochemical information, important to understand the status of tissue pathology, whereas the biomarkers are currently not available for every cancer type. Therefore, RS appeared to be suitable to provide specific molecular information on biochemical changes in fresh frozen tissues, and modern Raman microscopes are well adapted for this kind of application. The number of articles describing the results of RS application for various body tissue and cell pathologies are increasing in exponential way, proving that it can be a valuable tool for diagnostic purposes in clinics.

In this work, we applied RS for several tasks, among them to differentiate between thyroid follicular patterned lesions and among thyroid nodule pathologies [1,2]; to discriminate normal parathyroid tissue from adenoma [3]; to discriminates malignant follicular lymphoma from benign follicular hyperplasia, from tumor metastasis and to classify follicular lymphomas according to tumor grade and BCL2 protein expression [4].

The obtained proof-of-concept results demonstrate the great potential of RS for the above mentioned tasks. However, further work with the increased number of patients is needed to validate the methodology and then to pass to clinical protocol level. The final goal is the RS translation into intraoperative diagnosis on frozen tissue sections, and the development of Raman portable fibre probe devices for intraoperative optical biopsy to contribute to clinical decision-making and reduce the unnecessary surgery.

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