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Diagnosis of Osteoarthritis at an Early Stage via Infrared Spectroscopy Combined Chemometrics in Human Serum: A Pilot Study

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Abstract
Methods applied for early diagnosis of osteoarthritis (OA) are limited. Early prevention and treatment can effectively reduce the pain of OA patients and save costs. The present study aimed to develop a rapid non-destructive detection method for early diagnosis of OA by evaluating infrared (IR) spectroscopy combined chemometrics. Our cohort consisted of (a) 15 patients with osteoarthritis (OA) and (b) 10 without clinical signs of the disease and they were used as controls. Attenuated total reflection Fourier-transform infrared (ATR-FTIR) spectroscopy was used to investigate serum samples (50 µL) collected from these patients. A supervised classification algorithm namely discriminant analysis (DA) was applied to evaluate the diagnostic accuracy spectral processing and chemometrics analysis allowed for detecting spectral biomarkers that discriminated the two cohorts. About 250 infrared spectra were statistically important for separating the groups. Peaks at 1000 cm−1 in OA serum were associated mainly with C–O stretching vibration associated with the changes in the proteoglycan contents previously reported in OA. A good overall classification accuracy of 74.47% was obtained from the DA model. Our findings indicated that this discriminating model, which incorporated the ATR-FTIR spectrum, could provide a rapid and cost-effective blood test, thus facilitating the early diagnosis of human OA. © 2023 by the authors.

Author Keywords
ATR-FTIR; biomarkers; blood testing; chemometrics; infrared spectroscopy; osteoarthritis; serum diagnostics

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