Light touch to improve rheumatoid arthritis diagnosis

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A new way of detecting rheumatoid arthritis using infrared light could offer an objective way of diagnosing the disease and monitoring treatment effectiveness, a University of Birmingham study shows.

The rapid, non-invasive technique could help clinicians diagnose the disease earlier, and assess how effectively the selected treatment is controlling the progression of the disease.

Rheumatoid arthritis (RA) is an autoimmune disease, in which the body's immune system attacks the lining of joints, causing painful inflammation and swelling. It affects around 500,000 people in the UK and current diagnosis relies on a combination of physical examinations by a consultant rheumatologist, blood tests, and scanning by X-ray or ultrasound. Analysing these can be time-consuming, but also subjective, requiring highly-trained staff.

The new technique, developed by a team in the University of Birmingham's School of Computer Science in partnership with Health Technologies Institute and Rheumatologists in the NIHR Birmingham Biomedical Research Centre, combines 3-D digital imaging with infrared spectroscopy to create a 3-D image of blood content inside a patients' hand that can be used to produce an objective, quantifiable assessment.

The patient places a hand inside the scanner, which first creates a 3-D model of the hand, measuring its size and contours. In the next step, an infrared beam is directed through each finger in turn and the amount of light coming out through the finger is measured. Because oxygenated and deoxygenated blood absorb light differently, it's possible to use the infrared imaging to calculate warning signs of RA such as hypoxia—lowered levels of blood oxygen—and increased levels of blood content, an indication of inflammation.

"We know that diagnosing patients with RA early is really important, because early treatment leads to better long-term outcomes," explains Professor Hamid Dehghani, who led the study. "The system we have developed offers a low-cost, objective way of detecting the disease and potentially grading how advanced it is. We hope, in time it will enable clinicians to diagnose the disease earlier and offer personalised treatment plans for patients."

In a pilot study, the team examined 144 joints from 21 rheumatology patients and were able to detect accurately inflamed joints, with results closely matching diagnoses made using ultrasound and clinical examination. The results are published in the *Journal of Biomedical Optics*.

More information: Lighter et al (2019). 'Detecting inflammation in rheumatoid arthritis using Fourier transform analysis of dorsal optical transmission images from a pilot study'. *Journal of Biomedical Optics*.

Provided by University of Birmingham