

Post-mortem interval of skeletal remains accurately determined through non-destructive techniques

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Luis Bartolomé and Alfredo Sarmiento. Credit: Jorge Navarro

A UPV/EHU study has for the first time determined the post-mortem interval of human skeletal remains using real samples, which has been

made possible by the combination of two non-destructive analytical tools: Raman spectroscopy and chemometrics. This opens up new avenues for dating in the field of forensic medicine and anthropology.

In the field of forensic analysis there is a significant demand for objectively determining the post-mortem interval (PMI) when human skeletal remains are discovered. So far, a whole range of techniques have been used to establish the approximate time that has elapsed since the death of the individual, but they have significant drawbacks in terms of reliability and accuracy: they provide an approximate interval but not an exact date; they are relatively invasive techniques, which require staining or removal of a part of the bone, etc.

"The aim of this research was precisely to come up with a method capable of determining the relatively accurate post-mortem interval in human remains by using non-destructive measurements," said Luis Bartolomé, technician in the UPV/EHU's SGIker Central Analysis Service (SCAB).

"We analyzed a set of 53 actual human skeletal remains with a known post-mortem interval provided by the Department of Legal Medicine, Toxicology and Physical Anthropology of the University of Granada. Using actual samples for the first time, we built and validated a model by combining two non-destructive tools: Raman spectroscopy and chemometrics," said Bartolomé. "Raman spectra contain physico-chemical information on nearly all the components of the [sample](#); however, due to their complexity, in most cases it is not possible to differentiate between all the information they contain. Chemometrics is capable of extracting the parameters of interest from the spectra through mathematical and [statistical methods](#)."

"By combining both techniques, we have been able to build a model in which the Raman spectrum of each set of skeletal remains analyzed is

associated with a post-mortem interval. Relating the spectrum to a [time interval](#) is no easy task and for this we used statistical models and logarithms that allow us to relate each spectrum to a time. So when we receive human skeletal remains for which we don't know the [time](#) that has elapsed since death, what we do is an interpolation by inserting these data into the validated model, and that way a relatively accurate post-mortem interval can be obtained. The data recorded in the model developed provides valuable, potentially useful, versatile information."

According to Bartolomé, "The combination of both techniques is a significant achievement for forensic medicine and anthropology. However, there is always room for improvement as these types of models perform better the more samples there are and the more varied they are; the [model](#) includes more heterogeneity and responds more robustly to a wider range of cases."

More information: L. Ortiz-Herrero et al, Estimation of the post-mortem interval of human skeletal remains using Raman spectroscopy and chemometrics, *Forensic Science International* (2021). [DOI: 10.1016/j.forsciint.2021.111087](#)

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