

12 Real Forensic Caseworks Solved by the DNA STR-Typing of Skeletal Remains Exposed to Extremely Environment Conditions without the Conventional Bone Pulverization Step

Authors : Chiara Della Rocca, Gavino Piras, Andrea Berti, Alessandro Mameli

Abstract : DNA identification of human skeletal remains plays a valuable role in the forensic field, especially in missing persons and mass disaster investigations. Hard tissues, such as bones and teeth, represent a very common kind of samples analyzed in forensic laboratories because they are often the only biological materials remaining. However, the major limitation of using these compact samples relies on the extremely time-consuming and labor-intensive treatment of grinding them into powder before proceeding with the conventional DNA purification and extraction step. In this context, a DNA extraction assay called the TBone Ex kit (DNA Chip Research Inc.) was developed to digest bone chips without powdering. Here, we simultaneously analyzed bone and tooth samples that arrived at our police laboratory and belonged to 15 different forensic casework that occurred in Sardinia (Italy). A total of 27 samples were recovered from different scenarios and were exposed to extreme environmental factors, including sunlight, seawater, soil, fauna, vegetation, and high temperature and humidity. The TBone Ex kit was used prior to the EZ2 DNA extraction kit on the EZ2 Connect Fx instrument (Qiagen), and high-quality autosomal and Y-chromosome STRs profiles were obtained for the 80% of the caseworks in an extremely short time frame. This study provides additional support for the use of the TBone Ex kit for digesting bone fragments/whole teeth as an effective alternative to pulverization protocols. We empirically demonstrated the effectiveness of the kit in processing multiple bone samples simultaneously, largely simplifying the DNA extraction procedure and the good yield of recovered DNA for downstream genetic typing in highly compromised forensic real specimens. In conclusion, this study turns out to be extremely useful for forensic laboratories, to which the various actors of the criminal justice system - such as potential jury members, judges, defense attorneys, and prosecutors - required immediate feedback.

Keywords : DNA, skeletal remains, bones, tbone ex kit, extreme conditions

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