



DNA identification of skeletal remains by investigator's intuition

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ABSTRACT

In June 2006 a decapitated woman was found in a parking area of the motorway in the area of Prato (Florence). Since the body was beheaded and no victim's documents or objects were present at the crime scene, identification at that time was impossible. However, DNA profile from woman's bones were collected. In the same year (2003), a mother had reported her daughter's disappearance but the two events were not related at that time. About ten years later the mother's DNA profile was finally acquired for a genetic identification of another girl's body found in the Ferrara area. These genetic profiles were completely discordant. All these genetic comparisons were carried out on behalf of the prosecutors of the cities involved in the findings of the bodies and in the disappearance complaints, but due to the lack of a database the events remained disconnected. In January 2017, the head of the scientific police of Prato who had followed the investigation and questioned the mother of the missing girl found about ten years later, suggested to the magistrate to order the comparison of the mother's DNA with the genetic profile of the bones found in 2006. This comparison finally allowed the identification of the missing daughter.

This story highlights the importance of having forensic DNA database to search for missing persons and how the investigator's intuition can play a key role in resolving criminal cases. In fact, databases of unknown bodies and relatives of missing persons were created in Italy as a part of national DNA database just at the beginning of 2018.

1. Introduction

One of the main goal of the European Union (EU) is to promote common actions between the Member States in the field of police and judicial cooperation in criminal matters. In 2011 the EU Council, considering the Council Framework Decision 2009/905/JHA [1], formed the ambition to create a European Forensic Science Area by 2020 [2]. These indications have been collected from Italy by joining the Prüm Decision with the 30 June 2009 legislation n. 85 concerning the analysis of DNA, fingerprints and vehicle registration rules. The implementation of DNA legislation in Italy started seven years later, with the DPR 7 April 2016, n. 87 that indicates the necessity of the ISO/IEC 17025 standard for the laboratories that aspire to send DNA profiles to the Italian DNA Database. This legislation is intended to facilitate the identification of missing persons, because it allows feeding it with the profiles of corpses and with the DNA of family members who are looking for their relative. However, the current Italian distribution of laboratories accredited by ACCREDIA, the Italian accreditation body is limited and the DNA database of Ministry of the Interior started its activity only in 2018. Thus, it becomes fundamental that the technical data of the laboratory be used by investigators to make comparisons

with other corpses to be identified.

The body of a decapitated woman was found in June of 2006 by a truck driver in two garbage bags a in a motorway parking area in Barberino del Mugello at Km 251 + 700. DNA typing was performed from these post-mortem remains with a panel of short tandem repeat (STR) that can be used for comparison in the global DNA databases. However, the final identification of this body were realized only fourteen years after the mother's missing report and eleven years after the discovery of the body. Certainly an excessive time considering the analytical possibilities that the DNA test offers today, but obviously necessary before the introduction of the DNA legislation in Italy.

2. Material and methods

Cadaveric material from a small rib fragment was fragmented using a sterile mill and about 200 mg of powder were used for DNA extraction with EZ1 Advanced XL instrument, in combination with an EZ1 DNA Investigator Kit (Qiagen, Germany). Saliva samples were collected from the alleged mother of the missing girl. At the time of the first analysis DNA quantification and typing were performed using Quantifiler® Duo DNA quantification kit (Thermo Fisher Scientific, USA) and AmpFISTR®

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Table 1
DNA profiles for bone and alleged mother.

Locus	Bone	Alleged mother
D3S1358	14, 18	14, 16
VWA	16, 16	14, 16
D16S539	8, 12	8, 9
CSF1PO	11, 11	11, 11
TPOX	10, 11	10, 11
D8S1179	13, 15	13, 14
D21S11	27, 34.1	27, 29
D18S51	12, 16	16, 20
D2S441	10, 11	11, 11
D19S433	14.2, 16.2	14.2, 14.2
TH01	8, 9	6, 8
FGA	23, 24	21, 23
D22S1045	16, 17	15, 17
D5S818	12, 13	11, 12
D13S317	9, 12	11, 12
D7S820	8, 11	8, 11
SE33	19, 27.2	14, 19
D10S1248	15, 15	15, 16
D1S1656	14, 17.3	14, 14.3
D12S391	18, 21	18, 20
D2S1338	17, 18	17, 17
Yindel	–	–
DYS391	–	–
Amelogenina	X, X	X, X
Penta E	12, 13	12, 13
Penta D	9, 13	9, 13

Identifiler™ (Applied Biosystems). However, since a part of the fragmented bone had been preserved, it was possible to carry out a new analysis using Quantifiler® Trio DNA quantification kit (Thermo Fisher Scientific, USA) and PowerPlex® Fusion 6C System (Promega, USA). The typing was achieved using an 3500 Genetic Analyzer (Thermo Fisher Scientific, USA).

3. Results and discussion

Table 1 shows the typing results from the bone and the alleged

mother. At least one allele was shared between the two DNA profiles (in italics in the table). Using Familias ver.3 [3] the posterior probability ($P_{pr} = 50\%$) of identification was 99.99999999%.

4. Conclusion

The European drive to go in the direction of a vision for European Forensic Science in the 2020 seems to have been collected from Italy. In Italy at the moment the Italian institutional forensic laboratories (Carabinieri and Polizia di Stato) are ISO17025 accredited for DNA analysis, and so the Central Laboratory for the DNA database. It will probably take some time before the entire system that allows feeding the DNA database and identifying missing persons is fully started. In any case, and up to that moment, this story underlines how the investigator's acumen can still play a fundamental role in the resolution of a criminal investigation and in the identification of missed persons.

Declaration of Competing Interest

None.

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