

# A sexual homicide case from HLA-DQ $\alpha$ to 15 STR loci two sexual homicide defendants took fourteen years still waiting for the final judgment

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## Abstract

Two defendants were involved in a sexual homicide case in 1993, DNA HLA-DQ $\alpha$  typing and ABO blood typing tests were employed for this case. It was the first time the Court of Taiwan used forensic DNA testing thus the DNA testing procedure and the interpretation of DNA HLA-DQ $\alpha$  typing was unfamiliar ground. The standard operating procedure for collecting and preserving DNA evidence was also foreign to forensic examiners and consequently, chain of custody was occasionally neglected. During the delivery process, unknown specimens were mixed into the DNA sample collected from the victim. Therefore, the results in 1999 of DNA typing were miscellaneous. Furthermore, the 15 STR loci DNA typing results in 2006 were different compared to the DNA HLA-DQ $\alpha$  typing results in 1993. Due to inconsistent results, the Court was unable to make a final judgment. Until 2008, the two defendants had been sentenced to the capital punishment six times by the High Court. However, re-trials were ordered by the Supreme Court.

**Keywords:** forensic science, DNA typing, HLA-DQ $\alpha$ , 15 STR loci, sexual homicide.

## Introduction

A sexual homicide case occurred in December 1993, and involved two defendants. The DNA HLA-DQ $\alpha$  typing [1, 2] and ABO blood typing [3, 4] were employed. At that time, the forensic DNA testing was first used by the Court of Taiwan.

The reliability of the DNA typing was doubted by the Court thus the Court was unable to make a final judgment. Until 2008, the two defendants were ordered the death sentence six times by the High Court but the Supreme Court still ordered for a re-trial [5].

A span of fifteen years this complicated case was yet at a stalemate due to the Court's lack of knowledge about DNA and the interpretation of DNA typing results [6]. During the proceedings of this case, forensic technology

developed from DNA HLA DQ $\alpha$  typing to 15 STR loci DNA typing [7] and this is worthy of discussion.

## Case report

On December 22, 1993, a female body was found inside an apartment, the body was the result of a case of sexual homicide. The first defendant, a tenant of the apartment, was arrested by police. The first defendant confessed to the police that he and his friend were involved in the crime. His friend, the co-defendant lived with him and had been on parole for one week after released on parole from a fixed-term imprisonment of sexual sentence.

Police arrested the second defendant a few days later. The second defendant also confessed to the

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crime. However, after the ABO blood typing and DNA HLA-DQ  $\alpha$  typing [8], both defendants denied having committed the crime.

In December, 1993, ABO blood typing and DNA HLA-DQ  $\alpha$  typing were performed on the specimens from the case [9]. The ABO blood types of specimen from the victim's vagina, two defendants, and victim

were all the same, type O. The DNA HLA-DQ  $\alpha$  typing of specimen from victim's vagina, two defendants, and victim were (3,4), (3,4), (4,4), (1,2,4) respectively (Table 1).

The results here indicated that either the first defendant committed the crime or perhaps the two defendants committed the crime together [10]. As the

**Table 1.** ABO Blood type, HLA-DQ  $\alpha$ , 15 STR loci Of semen from the vaginal swab, two codefendants, and victim.

Specimens	1993 ABO Blood type	1993 HLA-DQ $\alpha$
1.Semen from victim's vagina	O	(3,4)
2.First defendant's specimen	O	(3,4)
3.Second defendant's specimen	O	(4,4)
4.Victim's specimen	O	(1,2,4)

result was not affirmative, the reliability of the DNA typing evidence was doubted by the Supreme Court so the judgment was rescinded and the case was remanded to the High Court for a re-trial [11].

The DNA typing results could not clearly be interpreted by the forensic DNA examiner, the Court asked the National Taiwan University Hospital (NTUH) for another DNA typing in 1998 [12]. The DNA examiner only took one swab for DNA testing and its DNA typing results matched only with the victim. In 1999, the Court asked the NTUH for another DNA typing and this time the examiner took three swabs from the victim and two unknown specimens for DNA testing. The result was miscellaneous.

There were fourteen specimens taken from the victim and these were delivered between the Institute of Forensic Medicine (IFM) and NTUH. One piece was used for typing by NTUH in 1998, leaving thirteen. But in 1999, there was a total of seventeen pieces when NTUH received the specimens from IFM. So, there was an increase in one unknown tissue and three cotton swabs [13]. NTUH did not check with the IFM before testing and the results were difficult to understand. Accompanied with the mixture of four unknown specimens, the results of DNA typing became complex and hard to understand. In this case, the Supreme Court doubted the reliability of the DNA test evidence and remanded the case to the High Court six times. The Supreme Court also said

it was crucial for the High Court to confirm the test results before making the judgment. As a result, the two defendants spent more than fourteen years in detention jail waiting for their final judgment and sentencing.

In 2005, the High Court asked the Criminal Investigation Bureau (CIB) for another DNA typing. DNA examiners of CIB were competent with the forensic DNA typing technology and followed proper testing procedures. Fortunately, the specimens from the victim were collected by forensic medical experts and preserved in Kraft paper envelope [14], so the specimens still could be examined by newly developed forensic DNA typing technology twelve years later. Using the Acid phosphate reagent for a pre-test, the sperm was then separated from vaginal epithelial cells, and after DNA extraction of the sperm the STR typing was performed. Then multiple STR results were used to compare the specimens from the two defendants. The genotypes of the 15 STR loci from sperm and cell all matched that of the second defendant. As the Supreme Court sought after a confirmation of these DNA results, the DNA was re-tested again.

In 2006, the High Court asked DNA examiners of CIB to collect the saliva samples from the two defendants by using buccal swabs. STR typing was performed at 15 STR loci on gauze and pledget specimens from the victim and the buccal swabs obtained from the two defendants. The genotypes of the specimens from the victim's vagina

matched only that of the second defendant [15].

The explanations of DNA HLA-DQ $\alpha$  typing results were a variation [16]. In 1993, the results indicated either the first defendant committed the crime himself or two defendants committed together. In 2006, it indicated that only the second defendant committed the crime (Table 2). But the specimens that analyzed in 1993 and 2006 were

the same gauze, the reason for the different results might be the methods that used to extract DNA from sperm in 1993 and 2006 were different [17].

During the past fourteen years, DNA examiners of NTUH and the CIB interpreted the results of this case to the Court. As they used expert DNA terminology, the Court had difficulty in understanding therefore

**Table 2.** DNA test results on 1998, 1999, 2005, 2006 by NTUH and CIB.

Test year and specimens	1998 NTUH	1999 NTUH	2005 CIB	2006 CIB
1. 1993 gauze from vagina of victim	Without DNA typing	Without DNA typing	Sperm and cell 15 STR loci match with B <sup>b</sup>	Sperm and cell 15 STR loci match with B <sup>b</sup>
2. 1993 pledget from vagina of victim	Without DNA typing	Without DNA typing	Sperm and cell 15 STR loci match with B <sup>b</sup>	Sperm and cell 15 STR loci match with B <sup>b</sup>
3. 1993 3 cotton swabs from inner vagina of victim	Without DNA typing	2 swabs for test only match the DNA of C <sup>c</sup>	1 swab for test only match with the DNA of C <sup>c</sup>	Without specimen
4. 1993 4 cotton swabs from the front of vagina	1 swab for test only match the DNA of C <sup>c</sup>	1 swab for test Only match the DNA of C <sup>c</sup>	2 swabs for test only match with the DNA of victim	Without specimen
5. 1993 4 cotton swabs from outside vagina of victim	Without DNA typing	1 swab for test only female X chromosome	3 swabs for test only match with the DNA of C <sup>c</sup>	Without specimen
6. 1993 1 bloodstain cotton from left thigh of victim	Without DNA typing	Only female X chromosome	Without specimen	Without specimen
7. 1999 unknown tissue	Without this specimen	Unknown male DNA	Without this specimen	Without this specimen
8. 1999 3 unknown cotton swabs	Without this specimen	Unknown male DNA	Without this specimen	Without this specimen
9. 2006 1 buccal swab of A <sup>a</sup>	Without this specimen	Without this specimen	Without this specimen	D <sup>d</sup>
10. 2006 1 buccal swab of B <sup>b</sup>	Without this specimen	Without this specimen	Without this specimen	E <sup>e</sup>

<sup>a</sup> A: First defendant.

<sup>b</sup> B: Second defendant.

<sup>c</sup> C: Victim.

<sup>d</sup> 15 STR loci of first defendant buccal swab only D3S1358 (15,16) match with the 15 STR loci of gauze from vagina of victim.

<sup>e</sup> 15 STR loci of second defendant buccal swab match with the 15 STR loci of gauze from vagina of victim.

questioned the reliability of the test results. This was the reason why the Court still unable to make the final judgment.

## Discussion

*Five issues need to be addressed in this call.*

· Firstly, why the DNA tests result of 1993, 2005, and 2006 were difference?

The DNA tests conducted for the semen depended upon the techniques that were available in the laboratory. Compared with the method for the extraction of DNA from semen in 1993, there were new techniques and many commercial products that were available for the extraction of DNA from semen, blood, vaginal, and buccal cells in 2005 and 2006. In 1993, we used sonication procedures for the extraction of DNA from forensic-type semen specimens it is a multi-step procedure [18, 19]. In 2006, we could extract DNA directly from sperm cells so the DNA can be analyzed for sexual assault evidence. One of the techniques for rapid identification was the microchip-based one step DNA extraction and real-time devices [20]. The development of the new technique may be the reason that these DNA test results of 1993, 2005, and 2006 were difference.

· Secondly, can the Court follow the procedures of the DNA testing [21]?

In the past fourteen years, DNA typing technology has been developed rapidly. The trial went from 1993 to 2008 and during that time the DNA typing technology had been improved [22]. In recent years, computer software and hardware systems have improved noticeably fast. With the help of computers, forensic DNA typing also had a huge advancement for the duration of the trial. This means that forensic DNA examiners are obligated to find ways to describe forensic DNA typing results in a way that can be easy understood by the Court [23].

· Thirdly, are forensic DNA examiners a competent expert witness in Court [24]?

In 1993, the HLA-DQ $\alpha$  DNA typing results were used by the Court as evidence. The Court needed to be provided with a simple but thorough explanation of the DNA typing results. If forensic DNA examiners used accessible language to explain the DNA typing in court, that would be easier for the Court to understand and to make their judgment [25]. Explaining results of the DNA typing effectively to layperson without DNA knowledge

is an obligation of the forensic DNA examiner. From the Court's point of view, the Court themselves act as a gatekeeper for admissibility of scientific evidence [26]. It is vital for the Court to understand the DNA typing procedures and the results.

The process of selecting an expert to examine the DNA evidence and the reliability of the DNA evidence are the two most important parts needed to be discussed by the forensic DNA examiner and the Court.

· Fourthly, is the forensic DNA examiner competent enough to follow the standard procedure [27]?

In this case, the court doubts the DNA typing results is due to the mixture of unknown specimens. The unknown specimens were mixed into the evidence because Chain of custody was not followed in the sample handling process [28].

The physical evidence from this sexual case was well preserved, so that it could be used to identify the suspects in 2008. Modern DNA typing technology is well developed and can easily distinguish sperm cells from a female victim or a mixture of semen. However, if evidence is contaminated, the results will be useless. So, it is important that the standard procedure should closely be followed and be proved it in Court by forensic DNA examiners.

· Finally, do the methods of DNA extraction from the stain contains semen are the same as the DNA extraction from blood or saliva samples?

For the sexual abuse case, forensic DNA examiners need to use the different methods to locate semen on the physical evidence. They include the visual test, tactile approach, acid phosphate mapping, and using light for visualizing semen [29]. After sperm has been located in the semen, the DNA of the sperm needs to be extracted from the semen. Special extraction methods are required to release DNA from sperm heads. For instance, the process of differential lysis is used to separate the sperm cells or male fraction from the non-sperm cells.

The forensic scientist often has to cope with problematic samples from the crime scene due to their size and thus the amount of extractable DNA. In this case, the sperm need to be separated or extracted from cells of the decayed tissue samples [30]. When the Court selects laboratories for DNA test regarding a sexual abuse case, it needs to be assured that the selected laboratory has credible experiences in forensic DNA typing [31].

## Conclusions

The forensic DNA evidence plays an important role in solving sexual assault and homicide cases [32]. DNA experts, researchers, and legal professionals agree that laypersons experience difficulty in understanding and applying aspects of DNA expert evidence [33]. From the trial history of this case, it can be concluded that the Court of Taiwan have doubts about the reliability of forensic DNA typing [34]. There are three main reasons questioning reliability. First, the Court doubted the procedures undertaken in the DNA typing. Second, the Court could not keep up with the fast developing DNA typing technology and lastly, forensic DNA examiners were unable to interpret the results clearly.

Forensic DNA examiners in Taiwan are not only obligated to deal with DNA typing with the standard operating procedure but are also required to help the Courts have a clear understanding of forensic DNA typing technology [35]. It is essential that examiners have practical research so they can prove the reliable and valid DNA typing results to the Court [36].

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