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Adhesive Tape as Forensic Evidence

Introduction

This research introduces a professional whose role is already well-defined In recent years, mapping the competency boundaries of various forensic expert fields and the possibilities for their collaboration has become a focus of my research. Working hand in hand with my expert colleagues, we have examined the activities of forensic pathologists, anthropologists, physicist experts and mark examiner fields through several publications, along with

their innovative results stemming from joint opinion formation that advance cases[1,2,3,4,5]. Our most recent manuscript presented complementary examination methods, including dactyloscopy and mark examiner fields, in the context of palm-print examination[6]. My colleague Péter Fülöp, a forensic physicist, describes the physics expert's potential to support the medical examiner in this context in this volume[7]. At the same time, the co-authors, Krisztina Tóth and István Kiss, discuss a quality-assured examination

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[5] Fullár, A. – Fülöp, P. – Ujvári, Zs. – Metzger, M. – Szécsi, A. – Varga, Gy. – Varsányi Balogh, M. – Petrétei, D.: Empirical and virtual experiments: reconstruction of an extraordinary death [Empirical and Virtual Experiments: Reconstruction of an Extraordinary Death]. Police Studies, Issue 2025/1-2. 81-96. o.
Source: https://doi.org/10.53304/PS.2025.1-2.06

[6] Fullár, A. – Petrétei, D. (2025): "I know it as my hand" – possibilities of multi-expert analysis of crime scene palm prints [„Ismerem, mint a saját tenyerem" – a helyszíni tenyérnyomok többszakértős vizsgálatának lehetőségei]. *Scienta et Securitas* 6:3, 279-291. o.
Source: https://doi.org/10.1556/112.2025.00304

[7] Fülöp, P. (2025): „Body physics" – Innovative options for supporting forensic medical expert practice in Hungary. Police Studies [under review]

methodology that supports reliable opinion formation in criminalistics[8]. This year's conference, themed *"Law Enforcement Research and Innovation"* on St. László Day, provided me, like my colleagues, with an excellent opportunity to further immerse myself in the topic, though from a slightly different perspective. Through an everyday object from our daily lives - adhesive tape - I demonstrate the collaboration possibilities of different forensic fields and the innovative opportunities of modern law enforcement.

What's worth knowing about adhesive tapes

Adhesive tapes are primarily items used in the packaging industry, but they also frequently come into our hands during DIY activities and daily tasks. Their widespread use is driven by their affordability, ease of access, size, variety, simplicity of use, and versatility of application. Different fastening challenges can be solved comfortably and quickly with their use. Some types can be torn off the tape roll, while others require a sharp cutting tool to section them. Their positive properties are well exemplified by the fact that this object is an indispensable component of survival kits even in space. In 1970, the crew of the Apollo 13 spacecraft was saved by fabric-reinforced adhesive tape, the so-called "duct tape," which helped them stably connect the air filter systems[9].

Adhesive tape is a self-adhesive tape that consists of a carrier surface and a pressure-sensitive adhesive. Different types of tapes differ in the materials of the two components and in their combination, which also influence the tape's behaviour and compatibility. The carrier surface can be, for

[8] Tóth, K. – Kiss, I. (2025): The importance of accreditation in forensic expert examinations [The Importance of Accreditation in Forensic Expert Examinations]. Police Studies [under review]

[9] (n.d.): Hogyan mentette meg az Apollo 13 legénységét a duct tape [How Duct Tape Saved the Apollo 13 Crew].
Source: https://raketa.hu/hogyan-mentette-meg-az-apollo-13-legenyseget-a-duct-tape
Accessed: 30.07.2025

example, paper, plastic, foil, fabric, or metal foil, while the adhesive material can be, for example, natural/synthetic/silicone rubber or acrylic-based. Depending on these, they can be bonded to materials such as paper, plastic, wood, ceramics, glass, or even metal. When using single-sided adhesive, we can bond objects placed side by side using an overlapping technique. In contrast, a double-sided adhesive can fix two materials together[10].

Adhesive tape from an expert perspective

Given the widespread distribution and use of adhesive tape, it can frequently be found at crime scenes as well. Perpetrators of crimes often use various tape types for restraining persons and securing them in a state incapable of defence and escape. By quickly taping the victims' eyes, it is possible to prevent potentially accurate personal descriptions of the attackers later, and by taping the mouth, help-seeking can be prevented. Insulation tape frequently turns up at bombing attack scenes as well, where it can remain undamaged on the surfaces of device components used in the explosion.

During the use of adhesive tapes, traces, biological, and micro-material residues from both victims and perpetrators can transfer to both the adhesive-coated and adhesive-free surfaces of the tapes, which can later be subjected to expert examination. Since adhesive tapes are good trace carriers, they can provide diverse information during the proof of crimes; however, they are also difficult-to-handle pieces of evidence due to their sticky surface. For this reason, it became necessary to map and summarise the examination methods for this type of evidence. The Fire and Explosion Working Group of the European Network of Forensic Science Institutes (ENFSI) developed a best practice manual and guidelines on this topic in 2013[11]. Using flowcharts, they illustrate which examinations should be performed

[10] (n.d.): Ragasztószalagok [Adhesive Tapes]. Source: https://www.frogpack.hu/kategoriak/ragasztoszalagok Accessed: 30.07.2025

[11] (2013): Forensic tape examination guidelines [Forensic Tape Examination Guidelines]. 30.10.2013

in what order to extract the most relevant information from adhesive tape as evidence. Since in most crime investigations we first seek to identify who committed the act, source-level personal identification examinations, such as genetic and dactyloscopy examinations, are placed at the beginning of the sequence. After these, sampling procedures can also be performed that try to answer the what and how questions, so activity-level results can be obtained with their help. As a consequence, a presentation by Richard Visser, a colleague from the Netherlands Forensic Institute, was given at the 2024 ENFSI SPTM (Shoeprint and Toolmark Working Group) meeting in The Hague, in which he detailed the investigative examination of the manufacturing characteristics of "duct tape"- type adhesive tape. He demonstrated that, in addition to the proper examination of adhesive tape ends, they evaluate the linear impressions formed on the carrier material during the winding of the tape roll, as well as the structure of the carrier material and the textile reinforcement fibres.

The Hungarian Institute for Forensic Sciences (HIFS), as an ENFSI member institution, strives to incorporate best-practice guidance into the working methods of accredited laboratories. The application of proficiency tests serves as a good basis for standardising, developing, and controlling individual examination methods. To demonstrate proficiency in adhesive tape examination, we chose the FTS (Forensic Testing Service) proficiency test round for 2025. The test's speciality is that the task spans two expert fields, so cooperation between a mark examiner and a forensic chemistry expert is required to complete it successfully. This year's test contained a tape roll with a torn end and two tape pieces with torn ends. The goal was to prove in the most detailed way possible that the tape pieces originated from the same tape roll.

Mark examiners evaluate the possibility of physical matching through part-whole examination of tape ends (Figure 1). The size and formal properties of the tape roll are similar to both examination samples; however, only one end of one tape piece can be fitted completely to the questioned tape end. Therefore, the piece with the fittable tape end definitely originates

from the tape roll, while the other piece shows group-level matching in size and formal properties with both the tape roll and the other tape piece.

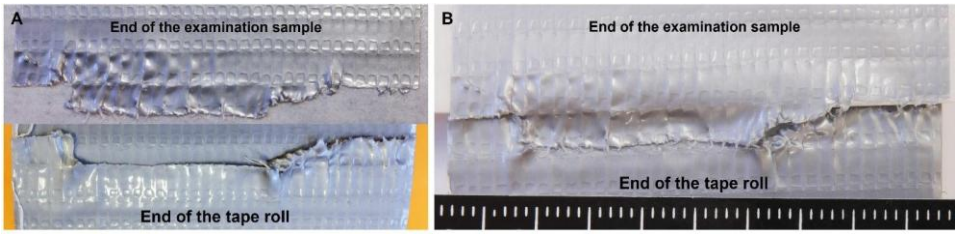

Figure 1.
A: The size and formal properties of the end of the tape roll show similarity with the end of the examination sample.
B: Physical match in metrical photo. (Recordings by Péter Lapis.)

Forensic chemistry experts first examine the layering and optical properties of the tapes using stereo and research microscopes, then reveal the chemical and elemental compositions of the plastic foil, adhesive, and textile reinforcement layers through infrared, Raman, laser-induced spectroscopy, and laser ablation inductively coupled plasma spectrometry. Based on the obtained spectra, the results confirmed the mark examination results, namely that both tape pieces could originate from the tape roll or from a roll with identical manufacturing properties.

Adhesive tape as evidence

Through practical examples, I would like to demonstrate, in the following, how experts can encounter adhesive tape as evidence across different case types and what methods they can use to make it speak during the proof process. I will present interesting cases from my mark examiner practice related to this topic through different types of tapes, that is, tape types that can be used in different ways.

In the first example case, a large quantity of weapons was seized hidden in the body elements of a vehicle inspected at the border. The weapons and separately stored magazines emerged wrapped in plastic wrap from cavities

created in the vehicle's body. Presumably to facilitate later pairing and assembly, they were wrapped with masking tape before packaging, on which number markings were written with a felt-tip pen. The weapons and magazines (Figure 2) underwent latent-print, genetic, and firearm-expert examinations. At the same time, the adhesive tapes peeled from the evidence were sent to forensic chemistry and handwriting experts, after a mark examiner. By examining the adhesive tapes, the appointing authority sought to determine whether the seized weapons were packaged at the same or different locations. The characteristic of masking tape is that it does not absorb moisture and can be easily and completely removed from surfaces without leaving adhesive residue. Markings can be applied to their thin crepe surface, and they can be easily torn by hand. For handwriting expert examination, photographs of the tapes in their original, adhered state were sufficient, while for forensic chemistry expert examination, smaller samples were adequate. The part-whole examination of the tape, based on more than 80 pieces of evidence, promised to be challenging. For the mark examination, I prepared the peeled tape pieces on transparent document film so that the torn tape ends could be easily fitted next to each other during pre-sorting. The beginning and end points of unwinding were marked and documented in photographs. Based on examinations by the mark examiner and a forensic chemistry expert, conducted following the pattern of proficiency tests, adhesive tape wound on both weapons and magazines could have originated from the same type of tape roll. Through part-whole examination, nine longer and shorter tapes were fitted together. Based on the handwriting expert's results for the number markings applied with a similar-coloured felt-tip pen, and considering the expert examinations, it could be concluded that the packaging of weapons and magazines occurred at one location.

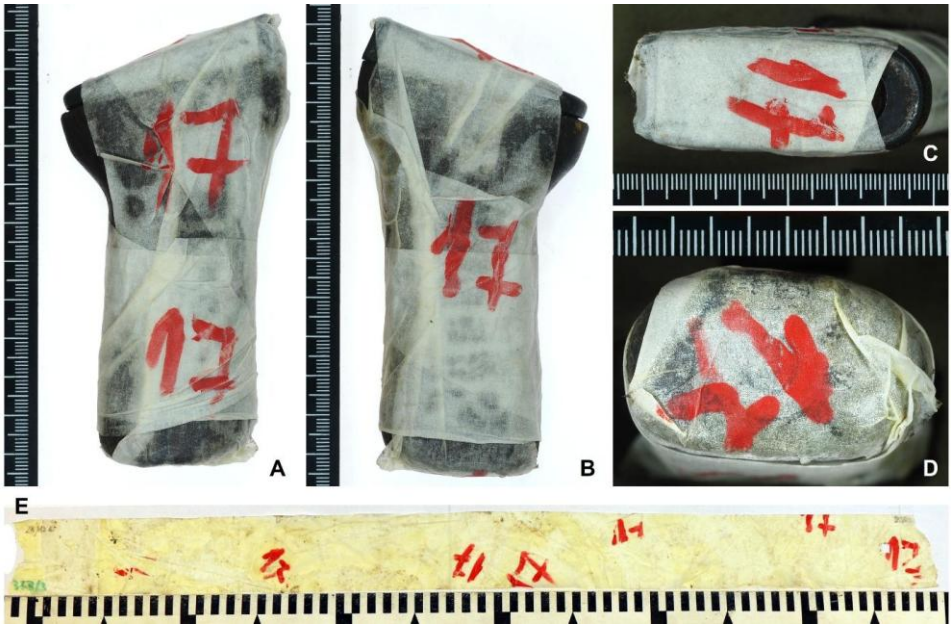

Figure 2.
A-D: Number-marked magazine wrapped with masking tape, recovered from the car door.
E: Number-marked masking tape from the magazine.
(The author's own recordings.)

Surprisingly, I encountered electrical tapes in connection with death case investigations during my expert work. This tape type, used in electrical work and available in multiple colours, is also suitable for mechanical fastening when needed; however, this function is not permanent. In both example cases, the perpetrator exploited this latter property. In one homicide case, a bloody garbage bag wrapped in a rubber glove with red electrical tape wound around it was found in the trash at the crime scene (Figure 3). As a result of a detailed examination of the criminal case examined by a medical expert and a mark examiner, it could be established that the killer used the adhesive tape to fix the garbage bag in front of the victim's mouth. This was most evident from bloody impressions on the face and from hair strands stuck in the adhesive tape. Changes indicating suffocation could not

be established, nor did the fastening method of the adhesive tape indicate that the perpetrator intended to block the airways with the garbage bag. Overall, it could be concluded that the hastily improvised device assembly rather served the purpose of preventing blood coughed up by the victim from getting on the perpetrator due to prolonged stab wounds targeting the lungs and internal organs.

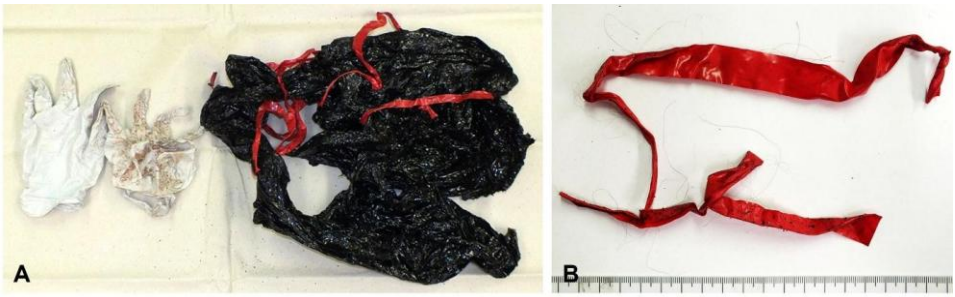

Figure 3.
A: A bloodstained trash bag wrapped in a bloody rubber glove and sealed with red electrical tape, recovered from the trash bin at the crime scene.
B: Electrical tape with adhered hair. (The author's own recordings.)

In the other homicide case, which was a case of my expert colleagues, the victim's companions fastened two plastic chairs with electrical tape to a victim who had fallen asleep from alcohol intoxication. The person who became incapable of self-rescue could not free himself from the captivity of the chairs and died because of hypothermia. The tensile strength test and model experiment performed during the physics expert examination vividly demonstrated what problem the victim might have faced when trying to free himself from his shackles. The mark examination noted that, in this type of case, adhesive tapes can only be examined in their original state; packaging them as evidence makes it impossible to determine which tape was applied to the plastic chairs in what order (Figure 4).

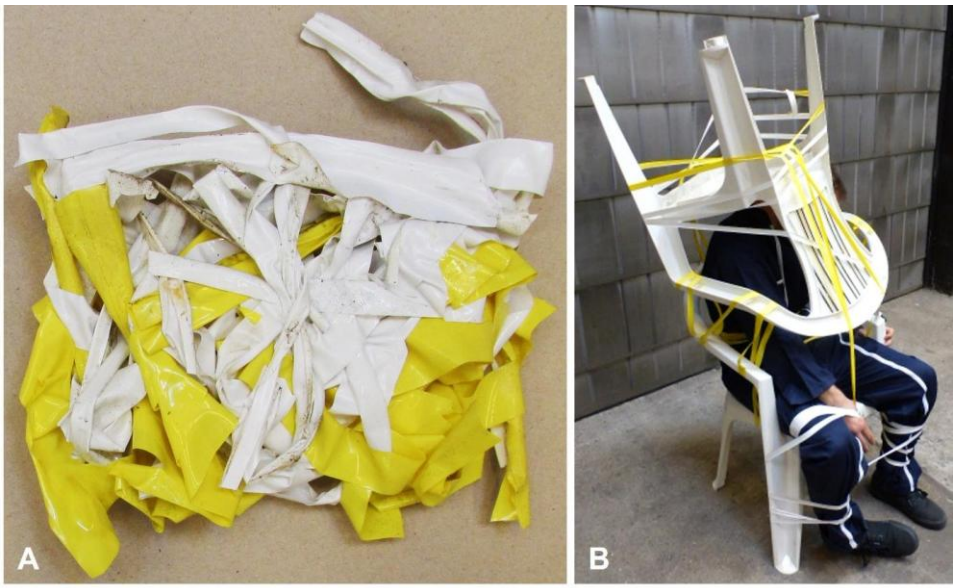

Figure 4.
A: Adhesive tapes collected at the crime scene by the forensic technician, in the condition submitted for expert examination.
B: Close-up from the experiment reconstructing the original position of the adhesive tapes and the chairs. (Recordings by Péter Fülöp.)

In my last example case, the previously mentioned "duct tape"- type adhesive tape, consisting of a plastic carrier surface with textile reinforcement fibres and a strong adhesive, came to the centre of the case and the proof. The characteristic of this tape is its mechanical resistance; elongation changes occur under longitudinal force. It can only be torn by hand after the tape edge has been initiated, for example, by cutting or biting. Through multi-expert examination of the adhesive tape, using the preparation of joint expert opinions, a final condemnatory judgment was reached after more than 10 years. During an armed robbery, two perpetrators attacked a couple in their own home while sleeping, wanting to obtain valuables stored in the safe. During the examined act, a pillowcase was fastened to the male victim's head with adhesive tape so he could not see, while one perpetrator locked the female victim in the bathroom. They forced the man

to open the safe, then finally fastened him to a lounge chair with adhesive tape. After the attackers left the house, the man was able to slip out of the restraint and call the police. Genetic and fingerprint experts first examined the adhesive tape wound on the armchair upholstery. The dactyloscopy examination did not lead to results; according to the victims' testimony, the perpetrators wore gloves. The geneticist cut off three free adhesive tape ends from the evidence ensemble originally sent with the armchair upholstery, for further examination. At one end, in addition to the male victim's biological sample deposit, a foreign profile was detected. Two years after the crime, one perpetrator was captured thanks to the stolen items, but his companion remained unknown to the authorities. Ten years later, the genetic database showed no match for the unknown profile from one tape end. At this point, the investigating authority faced a situation in which only the incriminating genetic sample deposit pointed to the suspect's guilt. The suspect explained that he could have touched the adhesive tape roll in the store from which the on-site tape pieces originated. Ten years after the crime, the authority again sent the adhesive tape remnants for expert examination, so that the forensic chemistry expert and mark examiner could determine from which part of the tape the detected genetic profile originated. Additionally, it sent an adhesive tape roll seized in the case of the other previously captured perpetrator for examination to determine whether the adhesive tape pieces found at the scene could have originated from it. The size and pattern of the carrier surface of the seized tape roll, and the course of the textile reinforcement fibres, differed from those of the on-site samples, while the latter were similar to each other. The morphological examination of the tape pieces was also confirmed by the forensic chemistry expert's results, which indicated that all tape pieces found at the scene could have originated from a single tape roll, but not from the one we examined. The trace evidence examination was greatly hindered because, during the previous chemical trace detection procedure, the three tape units, which were stuck together in multiple layers, were cut, and the procedure partially dissolved the adhesive material. Based on the forensic chemistry expert's guidance,

the textile reinforcement and adhesive layers can be removed from the tape pieces using an acetone solution and scraping, so that, when prepared on transparent document film, the tape ends become suitable for fitting examination. Fortunately, cut ends were created during chemical trace detection and genetic sample collection. In contrast, torn ends were created during the examined act, so the relevant tape ends became clearly distinguishable from one another. Based on the male victim's account, the tape piece first went around his head, whose diameter was significantly smaller than the other two tape units wound around his body, so even after this much time, the original position of the tape pieces became reconstructable. To my great surprise, inside the tape unit, wound around the head, I found a folded-back tape end. From this, I concluded that the perpetrators did not bring a store-condition tape roll with them, but started one with a pre-folded starting end for easier use. This recognition also provided the opportunity to determine the starting point of the tape sections unwound during the crime. Based on part-whole examinations conducted from this starting point, I finally concluded that during the examined act, at least 10 meters of tape was unwound from the adhesive tape roll, from the last, torn-type end of which the forensic genetic expert colleague detected the suspect's genetic profile. Through collaborative thinking and joint work across different forensic fields, the suspect's defence could be refuted, since his biological sample deposit could have been deposited only on the last torn tape end during the examined event.

Summary

Adhesive tape is a common tool in everyday life that also appears as increasingly important evidence in criminalistics. Through this study, I sought to highlight how adhesive tapes can contribute to the detection and proof of crimes through cooperation among different expert fields.

The diversity of adhesive tapes – in material composition, carrier surface type, and adhesive material – provides numerous examination possibilities. From an expert perspective, these objects can carry information that can be

examined from genetic, dactyloscopy, physical, chemical, and mark evidence standpoints. Through examinations performed in a specific order based on proficiency testing certification and ENFSI recommendations – such as biological trace analysis, material structure investigation, and fitting examination – both the origin of tape pieces and the method of their use can be reconstructed.

The study illustrates, through several practical examples, that adhesive tape is relevant to numerous crime types, including weapons smuggling, homicide, and armed robbery. The study emphasises the significance of cooperation between multiple fields – mark examiners, chemists, geneticists, and fingerprint experts. The complexity and precision of forensic expert work can only be ensured through such interdisciplinary cooperation, especially in cases involving complex evidence such as adhesive tape. Supported by evidence from practical experience, the study points out that, with appropriate examination methodology and coordinated work, adhesive tape can serve as valuable evidence in law enforcement.