Bibliography details

Name of the Serial/Publication: Veritas

Volume No.: 1

Issue No.: 2

Month & Year of publication: February 2022

Page numbers: Global Forensic Updates (60-63)

Title of Article: The Science of Touch DNA

CONTRIBUTOR (s)

1. Ms. Arsha Sahadevan

THE SCIENCE OF TOUCH DNA

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Ms. Arsha Sahadevan

Deoxyribonucleic acid (DNA) is an organic, self-replicating molecule that acts as the carrier of genetic material in organisms. It aids the growth, development, and reproduction of organisms. Besides identical twins, all individuals possess unique sequences of DNA. The significance of DNA evidence arises from this individualistic nature. In a forensic setting, the conventional sources of DNA include blood, semen, saliva, urine, bone, and hair.

What is the concept of touch DNA?

The concept of "touch DNA" began gaining acceptance in 1997, when Roland A. H. Van Oorschot and Jones discovered that DNA profiles could be generated from touched surfaces. Touch DNA, also called trace DNA or contact DNA, is the DNA obtained from shed skin (epidermal) cells transferred onto a surface during physical contact like touching. The amount of touch DNA on a surface of contact can vary between a few nanograms.

What is the forensic significance of touch DNA?

As per the exchange principle proposed by the French criminologist Edmund Locard, whenever two objects come in contact, there occurs a transfer of material between them. This principle highlights the significance of touch DNA as trace evidence. Touch DNA is highly effective in generating DNA profiles when biological fluids like blood, semen, saliva are unavailable for DNA extraction. Therefore, it finds importance in sexual assault, murder, homicide, burglary, and questioned documents cases.

What are the possible substrates on which touch DNA could be deposited?

Essentially, physical contact with any items like clothing, steering wheels, mugs, door handles, knobs, windows, ropes, ligatures, documents, firearms can leave behind touch DNA.

What factors affect the amount of touch DNA transferred?

- **Shedder status - Shedder refers to the individual handling an object, causing transfer of touch DNA. Individuals who left behind adequate amounts of touch DNA capable of generating complete DNA profiles immediately after washing hands are termed "good shedders" (tend to shed skin cells at a greater rate than others). The distinction between "good" and "bad" shedders remains debatable as the shedding of skin cells can depend on certain environmental factors or age, leading to a different shedding status each day.**
- **Perspiration - Sweat can contain epithelial cells from the sweat glands, contributing to more touch DNA on a surface of contact. It may also carry away certain cells from the skin surface, increasing the amount of transfer DNA. Additionally, when individuals touch their face, eyes, nose, or hair, there occurs a transfer of DNA from that area which Wickenheiser (2002) termed as "loading" of fingers with DNA.**
- **Type of contact - Studies conducted by Goray and others (2010) led to findings that increased pressure applied on the surface along with the friction that comes into play increased the amount of transferred DNA.**

- Substrate - Rough and porous surfaces like wood, concrete, and grooved surfaces increase the friction between the skin and surface, leading to greater amounts of touch DNA than smooth, non-porous surfaces.
- Time of contact - Existing research on handling time and the amount of DNA transferred during contact did not view significant variations among different handler times and the amount of touch DNA extracted from surfaces.

How can touch DNA be collected?

The most commonly equipped technique to retrieve touch DNA from surfaces is collection using sterile cotton swabs (wet/dry). However, this method has been found to cause significant sample loss (~20–76%) during extraction. Other methods include cutting out the area for soft surfaces like garments. The most effective technique is found to be tape lifting since it could extract DNA without significant sample loss.

What are the possible limitations to using touch DNA as evidence?

- Though touch DNA can be recovered from surfaces like doorknobs, multiple people come into physical contact with such surfaces leading to a mixture of DNA profiles. This would increase the workload in the laboratory.
- Contamination by the personnel handling evidentiary items cannot be overlooked when dealing with touch DNA.
- It has been found that DNA profiling from touch DNA samples on improvised explosive devices (IEDs) post-detonation has poor success rates.
- Evidence like fingerprints complicate the process of fingerprint development as some development techniques hamper DNA recovery.
- Individuals need not always transfer DNA upon touching surfaces. Furthermore, touch DNA is capable of secondary transfer. For instance, if a person uses a towel and the same is later used to wipe a gun, there occurs an indirect transfer of touch DNA to the gun. Thus, touch DNA can get transferred to a surface without direct physical contact with the surface.

Regardless of these limitations, touch DNA is still an emerging concept in the forensic field. Presently, several studies and researches are conducted, all aiming to examine the various aspects of touch DNA and its probative value in the justice system. Such analysis widens the scope of using touch DNA evidence for individualization in criminal cases.

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