Temperature Fluctuations as One of the Factors Affecting the Retention of Latent Papillae Pattern Prints

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Dactyloscopic traces are one of the types of evidence in criminal proceedings. Therefore, their ability to persist under the effects of external factors over different periods of time is of critical importance. The impact of external factors – whether sequential or simultaneous – can cause not only the partial or complete degradation of the traces themselves, but also of the object on which the traces are located. One of the external factors that can significantly affect the retention of sweat and grease traces is meteorological conditions [1–3], the impact of which on the traces cannot be prevented until the examination begins, at which point it is becomes possible to partially or completely mitigate the effects of meteorological conditions.

The objective of the experiment carried out as part of this study was to determine the preservation of latent papillae pattern prints under changing meteorological conditions.

The duration of the experiment ranged from 24 to 240 hours. Ten traces containing sweat and grease substance were deposited on each of the trace-receiving objects (10 glass and 10 plastic bottles), simulating the mechanism of formation of grip and pressure traces. To prevent the depletion of sweat and grease substance during the depositing traces, a short interval was observed. After the papillae pattern prints were placed on the objects, they were positioned in an open area and exposed to the effects of meteorological conditions. Black magnetic powder (Magnetic Jet Black) and black/silver magnetic powder (Magnetic TwoTone Silver/Black) were used to visualise the traces. A magnetic brush (Strong Magnetic brush) was applied for dusting the traces. For lifting the traces, silicone paste (Silmark CART White, 75 ml cartridge) was used, applied with a silicone paste dispensing gun (Dispensing gun (classic model) for Silmark CART), mixing tips for the gun (Mixing tips pink for Silmark CART), a spreader tip (Spreader tips for Silmark CART), and siliconized paper (Siliconized paper (one side only)).

A protocol was created for each object, in which the following were recording: the initial data of the experiment (the room temperature at which the latent papillae pattern prints were deposited on the object, the date, and the time); data recorded during the experiment (the condition of the surface of the object after being brought indoors, the drying time of the surface of the object, and the adhesion agents used to visualise the latent papillae pattern prints); and the results of the experiment. During the experiment, the effects of time range and meteorological conditions were studied, and the impact of temperature fluctuations on the retention of latent papillae pattern prints was analysed.

Table 1

Description of Meteorological Conditions

Time period, h	Meteorological elements		Weather conditions
	Air temperature at night, °C	Daytime air temperature, °C	
Deposition of traces	–1	–1	Cloudy, snowing
24	–3	–3	Cloudy, with occasional snow
48	–2	–3	Cloudy, no precipitation
72	+2	–1	Cloudy, with occasional snow

End of Table 1

Time period, h	Meteorological elements		Weather conditions
	Air temperature at night, °C	Daytime air temperature, °C	
96	+3	–4	Cloudy, no precipitation
120	–2	–5	Cloudy, with occasional snow
144	+3	+2	Cloudy, with occasional rain
168	+1	+3	Cloudy, with occasional rain and snow
192	+1	–3	Cloudy, no precipitation
216	+2	–1	Cloudy, with occasional rain and snow
240	–2	–3	Cloudy, snowing

After visualisation, the traces were divided into four groups: **A** – papillae pattern prints valid for person identification (12 or more distinctive features of papillary lines visible in the trace); **B** – papillae pattern prints invalid for person identification (less than 12 distinctive features of papillary lines visible in the trace); **C** – indication of touch/shape; **D** – no indication of touch/the trace deposited is not visible.

Table 2

The Evaluation Ratio of the Visualised Papillae Pattern Prints on Glass Objects

Evaluation of papillae pattern prints	Retention of latent papillae pattern prints under the influence of varying temperatures, °C									
	24 h	48 h	72 h	96 h	120 h	144 h	168 h	192 h	216 h	240 h
A	7	8	7	4	4	7	6	5	4	4
B	2	1	1	4	4	1	1	3	2	2
C	1	1	2	1	1	2	1	1	2	1
D	0	0	0	1	1	0	2	1	2	3

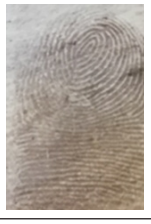
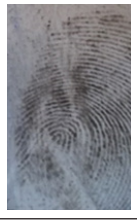
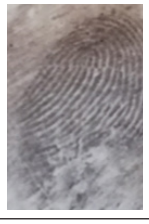
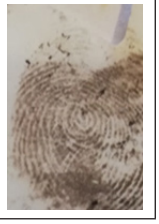
Table 3

The Evaluation Ratio of the Visualised Papillae Pattern Prints on Plastic Objects

Evaluation of papillae pattern prints	Retention of latent papillae pattern prints under the influence of varying temperatures, °C									
	24 h	48 h	72 h	96 h	120 h	144 h	168 h	192 h	216 h	240 h
A	7	8	7	4	4	7	6	5	4	4
B	2	1	1	4	4	1	1	3	2	2
C	1	1	2	1	1	2	1	1	2	1
D	0	0	0	1	1	0	2	1	2	3

Table 4

Papillae Pattern Prints Recognized as Valid for Person Identification

Material of the object	24 h	48 h	72 h	96 h	120 h
Glass					

End of Table 4

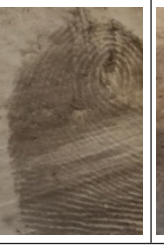
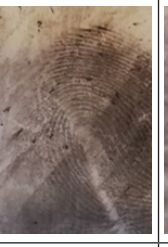
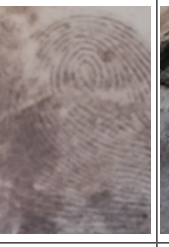
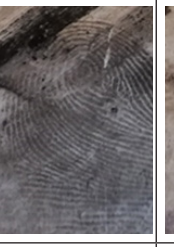
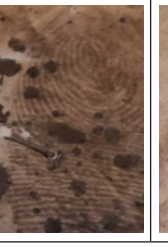
Material of the object	24 h	48 h	72 h	96 h	120 h
Plastic					

Table 5

Papillae Pattern Prints Recognized as Valid for Person Identification

Material of the object	144 h	168 h	196 h	216 h	240 h
Glass					
Plastic					

During the experiment it was confirmed that papillae pattern prints valid for person identification can be recorded 24 h, 48 h, 72 h, 96 h, 120 h, 144 h, 168 h, 192 h, 216 h, and 240 h following the simultaneous influence of meteorological conditions. Furthermore, the obtained results also allowed the conclusion that no progressive effect of time on the validity of the traces for person identification was observed.

References

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