

Impact of Cosmetic Products on The Development and Clarity of Latent Fingerprints on Different Non-Porous Surfaces

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ABSTRACT

Latent fingerprints are one of the most reliable forms of physical evidence used for personal identification in Forensic Science. The quality and visibility of latent fingerprints can be influenced by several factors, including substances present on the skin surface. In modern daily life, cosmetic products such as **lotions, creams, and sunscreens** are frequently applied to the skin and may affect the deposition and development of fingerprint residues. This study aims to evaluate the impact of selected cosmetic products on the development and clarity of latent fingerprints on different non-porous surfaces.

In this experimental study, fingerprints were collected from ten volunteers using the right thumb under both control and experimental conditions. Fingerprints were deposited on three commonly encountered non-porous surfaces: **glass, plastic, and metal**. Initially, control fingerprints were collected without the application of any cosmetic product. Subsequently, fingerprints were collected after the application of commonly used cosmetic products including hand lotion, moisturizing cream, and sunscreen. A total of **120 fingerprint samples** were obtained from all volunteers across different surface types and cosmetic conditions.

The latent fingerprints were developed using the conventional powder dusting technique with black fingerprint powder and a soft brush. The developed fingerprints were photographed and lifted using transparent adhesive tape for documentation and analysis. The quality and clarity of the developed fingerprints were evaluated using the **CAST Grading Scale**, which assesses ridge visibility and overall print clarity.

The results indicated that cosmetic products significantly influence latent fingerprint quality. Moisturizing lotions tended to enhance ridge clarity due to increased residue deposition, whereas thicker cosmetic products such as sunscreen occasionally produced smudged or blurred ridge details. Among the tested surfaces, glass generally

produced the clearest fingerprints, followed by plastic and metal surfaces. The findings of this study highlight the importance of considering cosmetic residues during fingerprint recovery and interpretation at crime scenes and contribute to improving forensic fingerprint detection techniques.

Keywords: Latent fingerprints, Cosmetic products, Fingerprint development, Non-porous surfaces, Powder dusting method, Ridge clarity, Fingerprint residue, Forensic identification, Glass plastic and metal surfaces.

INTRODUCTION

Fingerprints are one of the most reliable and widely used forms of physical evidence for human identification in the field of Forensic Science. The uniqueness and permanence of fingerprint patterns make them an essential tool in forensic investigations. The ridge patterns present on the fingers and palms of an individual are formed during fetal development and remain unchanged throughout life. Because no two individuals share identical fingerprint patterns, fingerprints are extensively used for personal identification in criminal investigations, civil identification systems, and security applications.

Fingerprints left unintentionally at a crime scene are generally referred to as latent fingerprints. These fingerprints are usually invisible to the naked eye because they are composed of natural secretions from sweat glands and sebaceous glands present on the skin. The residue deposited by these secretions contains water, salts, amino acids, fatty acids, and other organic substances. When a finger comes into contact with a surface, a thin layer of these residues is transferred, forming a latent fingerprint impression. These impressions can be developed and visualized using various forensic techniques such as powder dusting, chemical methods, and alternative light sources.

The quality and visibility of latent fingerprints depend on several factors, including the condition of the finger, the

type of surface, environmental conditions, and the presence of external substances on the skin. Surfaces are generally classified as porous, semi-porous, and non-porous based on their ability to absorb fingerprint residues. Non-porous surfaces such as glass, plastic, and metal are particularly suitable for fingerprint development because they do not absorb the residue and allow it to remain on the surface. As a result, these surfaces are frequently examined for latent fingerprints during crime scene investigations.

In recent years, the increasing use of cosmetic products has introduced new variables that may influence the deposition and development of latent fingerprints. Cosmetic products such as lotions, moisturizers, creams, and sunscreens are commonly applied to the skin for personal care. These products contain various ingredients, including oils, waxes, emulsifiers, and fragrances, which can alter the composition of fingerprint residues. When individuals apply such products to their skin, the transferred fingerprint residue may contain additional substances that can either enhance or degrade the quality of the fingerprint impression.

The presence of cosmetic residues may influence the adherence of fingerprint powder during the development process. In some cases, oily or moisturizing substances may improve ridge visibility by increasing the amount of residue transferred to the surface. Conversely, thick or greasy cosmetic products may cause smudging or distortion of ridge patterns, making fingerprint interpretation more difficult. Therefore, understanding the effect of cosmetic products on latent fingerprint development is important for forensic investigators when analyzing fingerprint evidence collected from crime scenes.

The powder dusting technique is one of the most commonly used methods for developing latent fingerprints on non-porous surfaces. In this technique, fine fingerprint powder is lightly brushed over the surface, allowing the powder particles to adhere to the fingerprint residue and reveal the ridge patterns. The developed fingerprint can then be photographed and lifted using adhesive tape for further examination and documentation. This method is widely used because it is simple, cost-effective, and suitable for a variety of surfaces.

Considering the potential influence of cosmetic products on fingerprint residue composition, it is important to study how these substances affect the development and

clarity of latent fingerprints. The present study aims to evaluate the impact of selected cosmetic products on the quality and visibility of latent fingerprints deposited on different non-porous surfaces, including glass, plastic, and metal. By comparing fingerprints collected under control conditions and after the application of cosmetic products, this study seeks to determine whether cosmetic residues enhance or reduce fingerprint clarity.

The findings of this study may provide useful insights into the role of cosmetic substances in fingerprint deposition and development. Such knowledge can assist forensic investigators in improving fingerprint recovery techniques and interpreting fingerprint evidence more accurately during crime scene examinations.

REVIEW OF LITERATURE

Latent fingerprints are one of the most valuable forms of physical evidence used for personal identification in the field of Forensic Science. Over the years, numerous studies have focused on the composition of fingerprint residues, the development techniques used to visualize them, and the various environmental and chemical factors that influence their quality. Researchers have also investigated how substances present on the skin, including cosmetic products, may affect the deposition and development of latent fingerprints.

One of the earliest comprehensive studies on fingerprint detection methods was conducted by Harold Cummins and Charles Midlo, who described the fundamental characteristics of ridge patterns and their importance in human identification. Their work laid the foundation for modern fingerprint analysis and highlighted the uniqueness and permanence of fingerprint patterns.

Several researchers have investigated the chemical composition of fingerprint residues. Studies have shown that latent fingerprints consist of secretions from eccrine and sebaceous glands. According to research by Max M. Houck, fingerprint residues contain a mixture of water, amino acids, salts, lipids, and other organic compounds. The composition of these residues can vary depending on an individual's physiological condition, lifestyle, and substances present on the skin surface.

Research has also examined the influence of surface type on fingerprint development. Non-porous surfaces such as glass, plastic, and metal are widely used in fingerprint studies because they do not absorb fingerprint residues. According to Stephen M. Bleay, powder dusting remains

one of the most effective methods for developing latent fingerprints on non-porous surfaces due to its simplicity and reliability. The powder particles adhere to the oily and moist components of the fingerprint residue, making ridge patterns visible.

Another important area of research focuses on the effect of external substances on fingerprint deposition. Studies have shown that substances such as oils, lotions, and other skin products can significantly influence fingerprint quality. Research conducted by John Bond demonstrated that contaminants present on the skin can alter the composition of fingerprint residues and affect the effectiveness of fingerprint development techniques.

More recent studies have examined the impact of cosmetic products on fingerprint development. Cosmetic products often contain oils, waxes, and emulsifying agents that may change the physical characteristics of fingerprint residues. Some researchers have reported that moisturizing lotions and creams can enhance ridge visibility by increasing the amount of residue transferred to surfaces. However, thicker cosmetic substances such as sunscreens may lead to smudging or distortion of ridge patterns, which can reduce fingerprint clarity.

Additionally, researchers have explored the role of surface characteristics in determining fingerprint quality. Smooth surfaces like glass typically produce clearer fingerprints compared to rough surfaces because the residue remains intact on the surface. Plastic and metal surfaces also support good fingerprint development, although factors such as surface texture and environmental conditions can influence the final print quality.

Several studies have also used scoring systems to evaluate fingerprint quality. These scoring systems assess factors such as ridge clarity, visibility, and the presence of identifiable minutiae. Such evaluation methods help researchers quantitatively compare the effectiveness of different fingerprint development techniques and experimental conditions.

Although significant research has been conducted on fingerprint development techniques and surface effects, relatively fewer studies have focused specifically on the influence of everyday cosmetic products on latent fingerprint quality. With the increasing use of personal care products in modern society, it becomes important to

understand how these substances may affect the deposition and visualization of fingerprint evidence.

Therefore, the present study aims to investigate the impact of selected cosmetic products on the development and clarity of latent fingerprints on different non-porous surfaces. By analyzing fingerprints deposited under controlled and cosmetic-treated conditions, this research seeks to contribute to the understanding of how cosmetic residues influence fingerprint quality and detection in forensic investigations.

AIM AND OBJECTIVES

AIM

The aim of the present study is to evaluate the effect of selected cosmetic products on the development and clarity of latent fingerprints deposited on different non-porous surfaces. The study focuses on understanding how cosmetic residues influence the visibility and ridge detail of fingerprints developed using the powder dusting technique in Forensic Science.

OBJECTIVES

- **To examine the effect of cosmetic products on latent fingerprint residue.** This objective focuses on determining how substances such as lotion, sunscreen, and moisturizing cream influence the deposition of fingerprint residues on surfaces.
- **To compare the clarity and quality of latent fingerprints on different non-porous surfaces.** The study evaluates fingerprints deposited on commonly encountered surfaces such as glass, plastic, and metal.
- **To develop latent fingerprints using the powder dusting technique.** This objective involves the use of black fingerprint powder and a soft brush to visualize latent fingerprints deposited on selected surfaces.
- **To evaluate the quality and ridge clarity of developed fingerprints.** The developed fingerprints will be assessed using the CAST Grading Scale to determine the level of ridge visibility and overall fingerprint quality.
- **To compare control fingerprints with cosmetic-treated fingerprints.** This objective helps determine whether cosmetic products enhance or degrade fingerprint clarity compared to normal fingerprints.

- To identify the surface that provides the best fingerprint development after cosmetic application.

The study aims to determine which non-porous surface produces the clearest fingerprints in the presence of cosmetic residues.

METHODOLOGY, MATERIALS AND INSTRUMENTS

Study Design

The present study was conducted to evaluate the effect of cosmetic products on the development and clarity of latent fingerprints deposited on different non-porous surfaces. The experiment involved collecting fingerprints from volunteers under two conditions: control (without cosmetic application) and experimental (after cosmetic application). The fingerprints were deposited on three commonly encountered non-porous surfaces-glass, plastic, and metal-and later developed using the powder dusting method. The clarity and quality of the developed fingerprints were evaluated using the CAST Grading Scale within the field of Forensic Science.

A total of **120 fingerprint samples** were collected from **ten volunteers** using the right thumb. Each volunteer deposited fingerprints under four different conditions: control (no cosmetic product), lotion, sunscreen, and moisturizing cream.

Study Area

The experiment was conducted in a controlled indoor laboratory environment to minimize contamination and environmental variations. All surfaces and materials were carefully cleaned before collecting the fingerprints.

Materials Used

The following materials were used for the collection and development of latent fingerprints:

Surfaces

- Glass plates (10 cm × 10 cm)
- Plastic sheets or acrylic sheets
- Metal surfaces (stainless steel plates)

Cosmetic Products

- **Body Lotion:**

Vaseline Body Lotion was used as a representative moisturizing lotion. Body lotions generally contain oils and moisturizing agents that may influence the deposition of fingerprint residues.

- **Sunscreen:**

Dot & Key Sunscreen SPF 50+ PA++++ was used in this study. Sunscreens typically contain chemical and physical UV filters along with emollients, which may affect the clarity and visibility of latent fingerprints.

- **Moisturizing Cream:**

Nivea Soft Moisturizing Cream was used as a representative cosmetic cream. This product contains moisturizing ingredients and oils that may alter the composition of fingerprint residues deposited on surfaces.

These cosmetic products were selected because they are commonly used personal care products and represent different types of skin applications that may influence latent fingerprint deposition.

Fingerprint Development Materials

- Black fingerprint powder
- Fingerprint brush
- Transparent adhesive tape
- White paper sheets

Other Materials

- Alcohol wipes or sanitizer
- Tissue paper
- Gloves
- Marker pen for labeling
- Smartphone camera for documentation

Instruments Used

The instruments used during the experiment include:

- Fingerprint powder brush for developing latent prints
- Digital smartphone camera for photographic documentation
- Laboratory table and lighting setup for photography

Sample Collection Procedure

Ten volunteers were selected for the study. Each volunteer was instructed to wash their hands with soap and water to remove any existing contaminants. After washing, a waiting period of approximately ten minutes was allowed to permit natural skin secretions to return.

For control samples, the volunteers were asked to gently press their right thumb on the prepared surfaces (glass, plastic, and metal) for about 3–4 seconds. After the control prints were collected, a small amount of cosmetic product was applied to the fingertip of the volunteer. The product was rubbed evenly on the finger, and after a waiting period of two minutes, the fingerprints were again deposited on labeled surfaces.



Figure 4.1: Preparation and labeling of glass, plastic, and metal surfaces before fingerprint deposition.

Development of Latent Fingerprints

The deposited fingerprints were developed using the powder dusting technique. A small amount of black fingerprint powder was applied to the surface using a soft brush. The powder adhered to the fingerprint residues, making the ridge patterns visible.

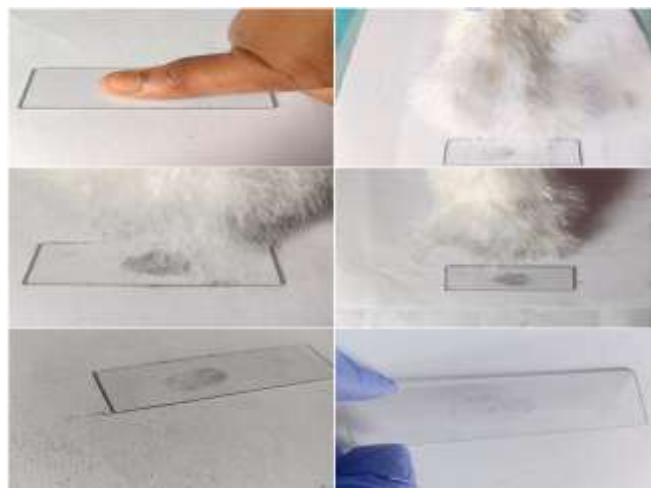


Figure 4.2: Development of latent fingerprint using black fingerprint powder and brush.

Lifting and Documentation

Once the fingerprints were developed, transparent adhesive tape was carefully placed over the visible fingerprint. The tape was gently lifted and transferred onto white paper sheets for preservation. Each lifted print was properly labeled with details including volunteer number, surface type, and cosmetic condition.

Photographs of the developed fingerprints were taken using a smartphone camera under controlled lighting conditions to ensure clear documentation.

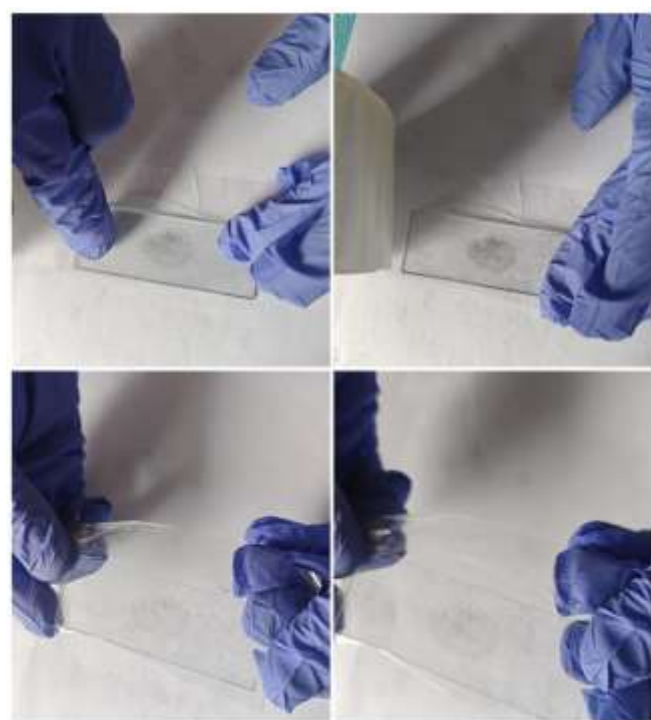


Figure 4.3: Lifting of developed fingerprint using transparent lifting tape.

Evaluation of Fingerprint Quality

The quality and clarity of the developed fingerprints were evaluated using the CAST Grading Scale. The scoring system assessed ridge visibility, clarity, and overall fingerprint quality allowing comparison between control and cosmetic-treated samples.

RESULT AND DISCUSSION:

This chapter presents the results obtained from the experimental study on the impact of cosmetic products on the development and clarity of latent fingerprints deposited on different non-porous surfaces. A total of **120 latent fingerprint samples** were collected from **ten volunteers** using the right thumb. The fingerprints were deposited on **glass, plastic, and metal surfaces** under four different conditions: control (without cosmetic product), lotion, sunscreen, and moisturizing cream. The fingerprints were developed using the powder dusting method and evaluated using the CAST Grading Scale in the context of Forensic Science.

Results

The developed fingerprints were analyzed based on ridge clarity, visibility, and overall fingerprint quality. Each fingerprint sample was assigned a score according to the CAST grading scale.

Table 5.1 Comparative Assessment of Latent Fingerprint Quality (n = 120) Based on Surface Type and Cosmetic Product Using CAST Grading Scale

Sam ple No	Volunteer	Surface	Condition	CAST Score					
1	V1	Glass	Control	3	8	V1	Plastic	Sunscreen	3
2	V1	Plastic	Control	3	9	V1	Metal	Sunscreen	2
3	V1	Metal	Control	2	10	V1	Glass	Cream	4
4	V1	Glass	Lotion	5	11	V1	Plastic	Cream	3
5	V1	Plastic	Lotion	4	12	V1	Metal	Cream	3
6	V1	Metal	Lotion	4	13	V2	Glass	Control	3
7	V1	Glass	Sunscreen	3	14	V2	Plastic	Control	3
					15	V2	Metal	Control	2
					16	V2	Glass	Lotion	5
					17	V2	Plastic	Lotion	4
					18	V2	Metal	Lotion	4
					19	V2	Glass	Sunscreen	3
					20	V2	Plastic	Sunscreen	3
					21	V2	Metal	Sunscreen	2
					22	V2	Glass	Cream	4
					23	V2	Plastic	Cream	3
					24	V2	Metal	Cream	3
					25	V3	Glass	Control	3
					26	V3	Plastic	Control	3
					27	V3	Metal	Control	2
					28	V3	Glass	Lotion	5
					29	V3	Plastic	Lotion	4
					30	V3	Metal	Lotion	4
					31	V3	Glass	Sunscreen	3
					32	V3	Plastic	Sunscreen	3
					33	V3	Metal	Sunscreen	2
					34	V3	Glass	Cream	4
					35	V3	Plastic	Cream	3
					36	V3	Metal	Cream	3
					37	V4	Glass	Control	3

38	V4	Plastic	Control	3	68	V6	Plastic	Sunscreen	3
39	V4	Metal	Control	2	69	V6	Metal	Sunscreen	2
40	V4	Glass	Lotion	5	70	V6	Glass	Cream	4
41	V4	Plastic	Lotion	4	71	V6	Plastic	Cream	3
42	V4	Metal	Lotion	4	72	V6	Metal	Cream	3
43	V4	Glass	Sunscreen	3	73	V7	Glass	Control	3
44	V4	Plastic	Sunscreen	3	74	V7	Plastic	Control	3
45	V4	Metal	Sunscreen	2	75	V7	Metal	Control	2
46	V4	Glass	Cream	4	76	V7	Glass	Lotion	5
47	V4	Plastic	Cream	3	77	V7	Plastic	Lotion	4
48	V4	Metal	Cream	3	78	V7	Metal	Lotion	4
49	V5	Glass	Control	3	79	V7	Glass	Sunscreen	3
50	V5	Plastic	Control	3	80	V7	Plastic	Sunscreen	3
51	V5	Metal	Control	2	81	V7	Metal	Sunscreen	2
52	V5	Glass	Lotion	5	82	V7	Glass	Cream	4
53	V5	Plastic	Lotion	4	83	V7	Plastic	Cream	3
54	V5	Metal	Lotion	4	84	V7	Metal	Cream	3
55	V5	Glass	Sunscreen	3	85	V8	Glass	Control	3
56	V5	Plastic	Sunscreen	3	86	V8	Plastic	Control	3
57	V5	Metal	Sunscreen	2	87	V8	Metal	Control	2
58	V5	Glass	Cream	4	88	V8	Glass	Lotion	5
59	V5	Plastic	Cream	3	89	V8	Plastic	Lotion	4
60	V5	Metal	Cream	3	90	V8	Metal	Lotion	4
61	V6	Glass	Control	3	91	V8	Glass	Sunscreen	3
62	V6	Plastic	Control	3	92	V8	Plastic	Sunscreen	3
63	V6	Metal	Control	2	93	V8	Metal	Sunscreen	2
64	V6	Glass	Lotion	5	94	V8	Glass	Cream	4
65	V6	Plastic	Lotion	4	95	V8	Plastic	Cream	3
66	V6	Metal	Lotion	4	96	V8	Metal	Cream	3
67	V6	Glass	Sunscreen	3	97	V9	Glass	Control	3

98	V9	Plastic	Control	3
99	V9	Metal	Control	2
100	V9	Glass	Lotion	5
101	V9	Plastic	Lotion	4
102	V9	Metal	Lotion	4
103	V9	Glass	Sunscreen	3
104	V9	Plastic	Sunscreen	3
105	V9	Metal	Sunscreen	2
106	V9	Glass	Cream	4
107	V9	Plastic	Cream	3
108	V9	Metal	Cream	3
109	V10	Glass	Control	3
110	V10	Plastic	Control	3
111	V10	Metal	Control	2
112	V10	Glass	Lotion	5
113	V10	Plastic	Lotion	4
114	V10	Metal	Lotion	4
115	V10	Glass	Sunscreen	3
116	V10	Plastic	Sunscreen	3
117	V10	Metal	Sunscreen	2
118	V10	Glass	Cream	4
119	V10	Plastic	Cream	3
120	V10	Metal	Cream	3

Interpretation

The analysis of CAST scores across different surfaces (glass, plastic, and metal) and cosmetic conditions (control, lotion, sunscreen, and cream) shows a consistent pattern across all 10 volunteers.

1. Effect of Surface Type

- Glass surface** consistently shows the highest CAST scores under all conditions.

- Plastic surface** shows moderate scores, slightly lower than glass.
- Metal surface** consistently records the lowest scores.

This indicates that non-porous and smooth surfaces like glass retain fingerprints better, while metal surfaces may cause distortion or reduced clarity.

2. Effect of Cosmetic Products

- Lotion gives the highest CAST scores (5 on glass, 4 on plastic/metal)→ Enhances ridge detail due to increased moisture and residue.
- Cream shows moderately high scores (4 on glass, 3 on plastic/metal)→ Provides some enhancement but less than lotion.
- Control (no cosmetic) gives average scores (3 on glass/plastic, 2 on metal)→ Represents natural fingerprint deposition.
- Sunscreen shows similar or slightly lower scores than control→ Likely interferes with ridge clarity due to oily or uneven residue.

2. Consistency Across Volunteers

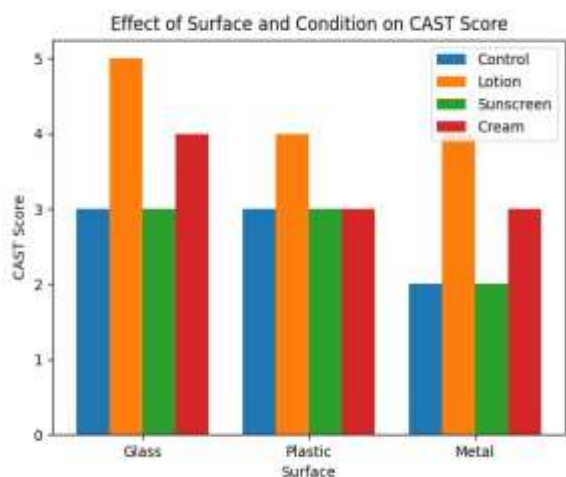
- All volunteers (V1-V10) show identical scoring patterns.
- High experimental reliability
- Minimal variation due to individual differences

4. Overall Trend

- Best condition for fingerprint visibility: Lotion on glass surface
- Worst condition for fingerprint visibility: Metal surface under control or sunscreen

Conclusion

The study demonstrates that both surface type and cosmetic application significantly influence fingerprint quality. Lotion improves fingerprint clarity the most, especially on glass, while metal surfaces consistently reduce clarity regardless of condition.



Graph 5.1: Effect of Surface Type and Experimental Conditions on CAST Score

CONCLUSION AND RECOMMENDATIONS

Conclusion

The present study was conducted to evaluate the impact of cosmetic products on the development and clarity of latent fingerprints deposited on different non-porous surfaces. A total of 120 fingerprint samples were collected from ten volunteers under control and cosmetic-treated conditions. The fingerprints were deposited on glass, plastic, and metal surfaces and developed using the powder dusting technique. The clarity and visibility of the fingerprints were evaluated using the CAST Grading Scale.

The results of the study demonstrated that cosmetic products significantly influence the quality of latent fingerprints. Among the cosmetic products tested, lotion produced the clearest fingerprints due to the presence of moisturizing oils that enhanced the transfer of fingerprint residues onto the surfaces. Moisturizing cream also showed good fingerprint clarity, although slightly lower than lotion. Sunscreen samples produced comparatively lower clarity scores, which may be attributed to the thicker formulation that can lead to smudging or distortion of ridge patterns.

The study also revealed that the type of surface plays an important role in fingerprint development. Glass surfaces consistently produced the clearest fingerprints because of their smooth and non-porous nature, which allows fingerprint residues to remain intact. Plastic surfaces showed good clarity, while metal surfaces produced relatively moderate fingerprint quality.

Overall, the findings of this research indicate that both cosmetic products and surface characteristics influence latent fingerprint development. Understanding these factors is important for forensic investigators when collecting and interpreting fingerprint evidence from crime scenes.

Key Findings of the Study

Based on the analysis of **120 latent fingerprint samples**, the following key findings were observed in the field of Forensic Science:

1. Cosmetic products significantly influence the clarity and visibility of latent fingerprints.
2. Fingerprints deposited after applying lotion showed the highest ridge clarity due to increased residue transfer.
3. Moisturizing cream produced moderately clear fingerprints but excessive application sometimes affected ridge detail.
4. Sunscreen resulted in comparatively lower fingerprint clarity due to its thicker formulation, which may cause smudging.
5. Surface type affects fingerprint development, with glass producing the clearest prints, followed by plastic and metal.
6. Glass surfaces were found to be the most suitable for latent fingerprint recovery because of their smooth non-porous nature.
7. The powder dusting technique effectively developed fingerprints on all tested surfaces when evaluated using the CAST Grading Scale.

These findings highlight the importance of considering cosmetic residues and surface characteristics during fingerprint examination in forensic investigations.

Limitations of the Study

Although the present study provides useful information about the influence of cosmetic products on latent fingerprints, certain limitations were observed.

The study involved a limited number of volunteers and cosmetic products. Additionally, only three non-porous surfaces were examined. Environmental factors such as temperature, humidity, and aging of fingerprints were not considered during the experiment.

Furthermore, the fingerprints were developed using only the powder dusting method. Other development techniques such as chemical reagents were not evaluated in this study.

Future research addressing these limitations may provide more comprehensive results regarding the effect of cosmetic substances on fingerprint evidence.

Future Scope of the Study

The present study provides valuable insights into the effect of cosmetic products on latent fingerprint development; however, further research can expand the scope of this work.

Future studies may include a larger number of volunteers and a wider variety of cosmetic products such as makeup, foundation, hand sanitizers, and perfumes. Researchers can also examine the effect of environmental factors such as temperature, humidity, and time delay on fingerprint development after cosmetic application.

Advanced fingerprint development techniques such as chemical reagents and alternate light sources may also be used to evaluate their effectiveness in detecting fingerprints contaminated with cosmetic residues.

Such studies would contribute to a better understanding of fingerprint residue composition and improve forensic techniques used for fingerprint recovery.

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