TO COLLECT AND RECOVER THE FINGERPRINTS FROM THE DISTRUCTED CRIME SCENE – A REVIEW

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Abstract:

Fingerprint plays a vital role in forensic examination as they unique in all and best method for the identification. Fingerprints are the patterns formed by the friction ridges and furrows present on the skin. There are vast number of methods for the development of latent fingerprints, but fingerprints present at the destructive crime scene like fire, arson, explosion are neglected because of misconception of being damaged by the extensive heats, flames, smoke, etc. The concept of this review paper is to clear the misconception of damaged and impossible recovery of evidence as well as about the methods for the recovery and collection of latent fingerprints present at such crime scenes.

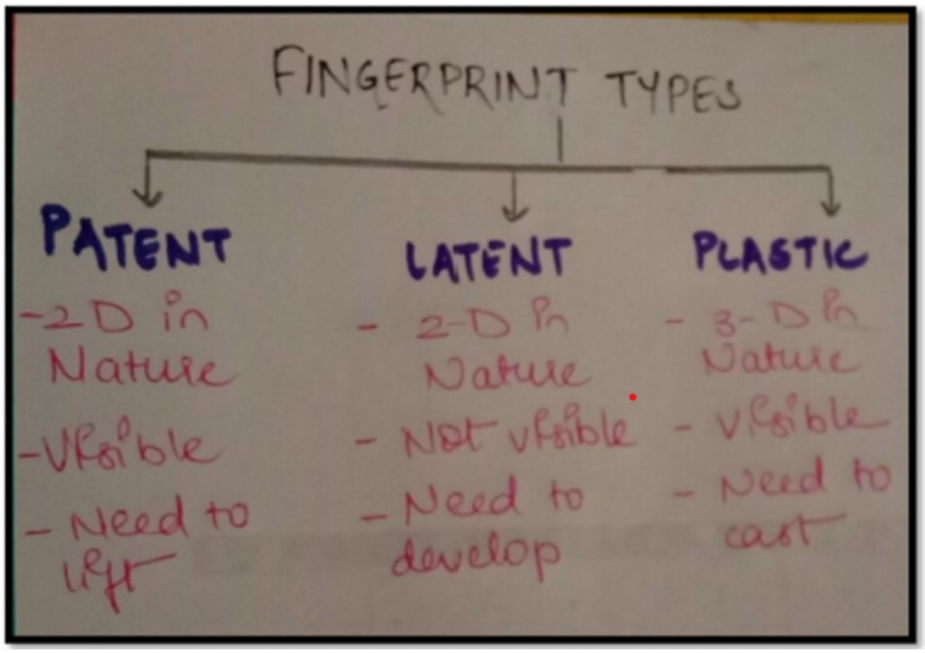
Keywords:

Destructive, Fingerprint, Forensic, Furrows, and Ridges

Introduction:

Fingerprint are unique, no two people can have same type of fingerprint. Even identical twins with identical DNA, have different fingerprints. Fingerprints are the patterns Formed by friction ridges and furrows on the skin. Because the unique feature of fingerprint it is used in various ways- biometric security, personal identification and in criminal investigations.

The study of prints is known as Dermatoglyphics. The use of fingerprint is to signify the actual patterns of the distal phalanx. Fingerprints are in used for more than 100 years for identifying the suspects and solved the crime cases. Fingerprints are of three types- Patent, Latent and Plastic. Most commonly latent or chance prints are found at the scene of crime and need to be developed for proper visibility and examination.

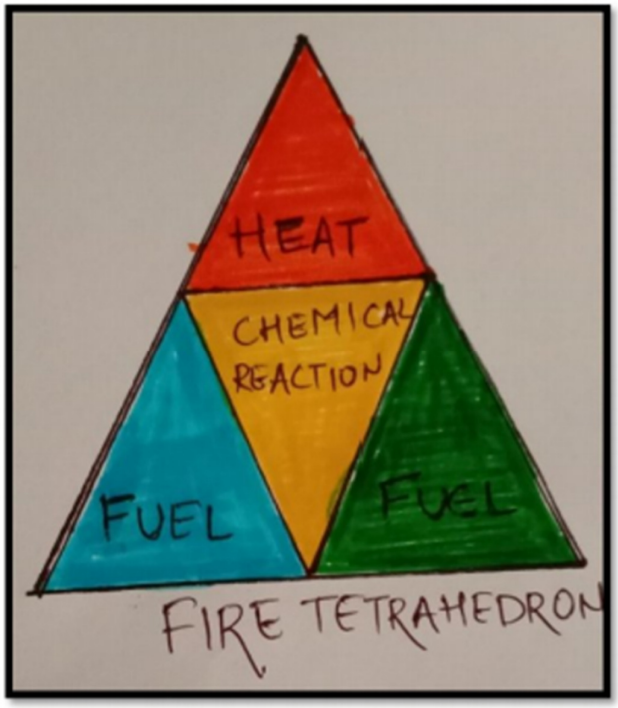


Fingerprints are the important evidence for identification. Proper location and recovery is important for the development of fingerprint and is required for criminal investigations. Development of fingerprints becomes a challenging task in the case of extreme exposure of temperature.

Fire

A fire scene may be accident or a case of arson. In terms of material costs, Fire scenes are the most expensive ones. And such types of scenes draw less attention when comes to the examination of scene for the fingerprints as misapprehension of damaged or destructed evidence due to extensive heat, flame and smoke.

Fire basically needs four components which form fire tetrahedron:



Fingerprints found at fire scene of crime are prolonged exposed to utmost conditions like high temperature, electromagnetic radiation, shoot deposition, heat, flame, smoke, explosion and hence lead to the misconception of destroyed evidence and remains less attended. The reason for this may be destructive nature of fire.

William Harper was the first who recovered fingerprints from fire scene.

It also necessary to study fire dynamics, fire patterns, fuel dynamics, fire science, heat transfer to know the behaviour of fires which aids investigation and also where to find the relevant evidences from the fire scenes.

Latent fingerprints mainly consist of sweat; 98% water and 2% Mixture of a skin oils, proteins, salts, urea and organic acids. Eccrine glands are responsible for formation of latent fingerprints as a responsible of majority of sweat secretion, and are located on palms and soles.

They are vast category of methods for the development of latent prints but when it comes to the prints present at the scene of extreme condition like fire, many different factors need to be considered, Fonta recovering of development of fingerprints, also depends upon the type of fire scene. Proper technique of leads to clear and proper Development of such prints. In fire cases shoot deposition also plays a vital role. Proper methods and techniques used for shoot removal results in proper visualization of latent prints.

Review Literature:

The paper presented by **Georgina Bradshaw, Stephen Bleay, Jack Deans, and Niamnh Nic Daeid** entitled **'Recovery of fingerprints from arson scenes: Part I- latent fingerprints'** reports a study into the recovery of fingerprints from fire scenes. They suggested that latent fingerprints can be collected after the proper method of soot removal. Laboratory demonstration results in development of fingerprint after prolonged exposure to high temperature. For soot removal techniques can be used for tape lifting, silicon casting compound and absorene. For marks development on non-porous surfaces, Black counter suspension, and for the porous surfaces physical developer was effective method.

A paper proposed by **Amy Richmond-Aylor et al** entitled **'Thermal degradation analysis of amino acids in fingerprints residue by pyrolysis GC-MS to develop new latent fingerprint developing reagents'** Suggested that alteration in Physical and chemical properties of latent fingerprint residue due to high temperature could aid in the discovery of a reagent that could effectively develop decomposed fingerprints due to high temperature. The five most common amino acids present in Fingerprint residue as well as extracted fingerprint residue which was under exposure of high temperature where pyrolised under controlled conditions. The identified compounds as pyrolytic decomposition were 3,6-dimethylpiperazine-2,5-dione, maleimide, and 2,5-furandione. The pyrograms and selected ion traces result as indicators of decomposed fingerprint residues with my result is substrates for a developing reagent.

J. Moore, S. Bleay, J. Deans, N. Nic Daied in their paper entitled 'Recovery of fingerprint from arson scenes: Part 2- Fingerprints in Blood' her performed a test in laboratory demonstrated that some of the protein dye the used for development of fingerprints in blood continue to develop marks after prolonged exposure of the print. The proper soot removal process used results in development of marks. The best performing soot removal techniques included silicon rubber Casting compound and absorbene. The best technique for development of marks on non-porous surfaces include ac violet 17 and for porous surfaces acid black 1. For the detection of position of marks on surfaces exposed to 900 degrees Celsius vacuum metal deposition technique can be used.

The research carried out **by Susan Wright Clutter M.F.S., Robert Balley, Jeff C. Everly B.S., Karl Mercer B.S. in their paper entitled 'The use of liquid latex for removed from fire scenes and attempted fingerprint development with ninhydrin'** Focuses on soot layer to removed prior to using fingerprinting processes. For this liquid latex was applied to suited surfaces to remove soot and yield fingerprints after the dried latex was peeled. Resulted unusable prints for the examination, but no further enhancement was noticed by ninhydrin. Liquid latex application results in suitable soot removal technique for forensic applications.

Jasmine Kaur Dhall, G.S. Sodhi, A.K. Kapoor portrayed in their paper entitled 'A novel method for the development of fingerprints recovery from arson simulation' that generally fingerprints exposed to extreme conditions like fire or arson are perceived to be damaged, as high forces, electromagnetic radiations, soot deposition are the major forces generated in fire. This study results in developing latent fingerprints exposed to a maximum temperature of 800 degrees Celsius using zinc carbonate based fluorescent small particle reagent.

A review article presented by **Andrew O'Hagan; Rosalee B Banham entitled 'A review of fingerprint recovery within an arson crime scene'** describes the possibilities of fingerprint recovery in arson investigation. As there is a misconception that fire destroys everything, but evaluation results in excellent development of fingerprints. The recovery of fingerprints results in proper examination

according to the temperature conditions at each stage and using proper soot removal techniques. Further research is required to make advancement in fire scene fingerprint recovery.

The research work carried out by **Jasmine Kaur Dhall, A.K. Kapoor on paper entitled 'Development of latent prints exposed to destructive crime conditions using wet powder suspension'** Focuses on recovery of fingerprints which have been exposed to destructive conditions like explosion, fire, arson, soil burial as neglected due to the misconception of destruction of prints. Wet powder suspension was found best technique for the development of prints and the efficiency of reagents was found in order TiO_2>$ZnCO_3$>ZnO. The best quality results found from fresh prints, soil burial and drainage water whereas poor quality results obtained from explosion and snow burial.

In the paper presented by **Andrew O'Hagan, Rebecca Calder entitled 'DNA and Fingerprint recovery from an arson scene'** Discussed about the techniques for the recovery of DNA and fingerprint based on types of fire scene as every fire is unique. For this stage of fire need to be considered and proper shoot removal techniques to be used for visualization. Through different enhancement techniques exceptional results obtained from both DNA and fingerprints exposed at high temperature.

A Research article presented by **Mark A. Spawn entitled 'Effects of fire on fingerprint evidence'** describes that items which were at the closest to the point of origin retains no fingerprint but the items which were away from the point of origin retains fingerprint ridge details. The research results in that adjacent rooms to the point of origin which received excessive heat and smoke but less flame, retains identifiable fingerprints when processed by cold water rinsing technique. Also, the nearby non porous objects to the point of origin generally retains no fingerprints whereas other objects which are few feet away from the point of origin retains identifiable fingerprints. It appears that soot layers over the objects Somehow leads to protect the residues of latent fingerprints.

J Deans in his article 'Recovery of fingerprints from fire scenes and associated evidence' Demonstrated that items have evidence recovered from fire scenes retains fingerprint ridge details which can be developed by normal fingerprint development methods. He suggested that lack of information and misconception related to the fire scenes leads to the impossible recovery of evidence, hence demonstrated her real-life fire and recovered the evidences. Also, the results depend upon the considerations to be put by the fire scene examiner for the resultant findings which leads the police in their investigation.

A research article presented by **Ainsley J. Dominick, Niamh Daeid, Stephen M. Bleay entitled 'The recoverability of fingerprints on nonporous surfaces exposed to elevated temperature'** describes the retrieval of ridge details on glass and ceramic surfaces after exposure to high temperature. But the ridge details only survive when not in contact with direct radiant heat and air flow across the surface. The Super glue followed by BY40 was the best technique for enhancement of fingerprints at all temperature except 200^o C, for that iron powder suspension technique is best. Super glue BY40 technique is not good for development over none porous surfaces as it become wet during firefighting activity. Silver metal deposition was also demonstrated for the development of fingerprints after exposure to high temperature and may have further potential for this application.

A research article presented by **U.K. Ahmad, Y.S. Mei, M.S. Bahari, N.S. Huat entitled 'The effectiveness of soot removal techniques for the recovery of fingerprints on glass fire debris in petrol bomb cases'** describes the methods for soot removal using three methods which were brushing, 2% NaOH solution and tape lifting. The prints which were visible properly after this method were

directly lifted and the one which were not properly visible undergo enhancement technique of superglue fuming for effective fingerprint identification.

N. Sanders in research article entitled 'Recovery of fingerprint from post-blast device materials' discuss the cyanoacrylate fuming and powers, Wetwop, or leucocrystal violet for the successfully development and recovery of fingerprint from the post-blast device materials.

The research work carried by **Sarah Jane Gardner, Thomas H. Cordingley, Sean C. Francis entitled 'An investigation into effective methodologies for latent fingerprint enhancement on items recovery from fire'** focuses on soot removal by tape lifting, sodium hydroxide, or liquid latex casting and for fingerprint enhancement comprised of black magnetic, aluminium and black powder suspensions, or cyanoacrylate fuming with BY40 dye. For the fingerprint recovery temperature is the biggest factor. No differences found in any of the soot removal techniques but for enhancement of fingerprint black magnetic powder and cyanoacrylate/BY40 were best techniques.

A paper proposed by **K.M. Stow, J Mc Gurry entitled 'The recovery of finger marks from soot-covered glass fire debris'** discussed methods using 1% and 2% NaOH solutions, ultrasonic bath and vacuum suction for the soot removal to reveal the latent and blood contaminated marks. The study leads to the conclusion that NaOH wash solution is best technique for soot removal and to reveal latent marks both within the laboratory and at crime scene.

E. Gardener in research article entitled 'Using a reflected ultraviolet imaging system to recover friction ridge impressions on blast material' proposed the use of reflective ultraviolet imaging systems (RUVIS) to reveal the latent print evidence survived intense thermal conditions. The research focuses on terrorist bombing incidents leads to mass destruction and evidence like fingerprints remained untouched because of the assumption that intense heat of the explosion would destruct them. Latent prints are generally present over tape and batteries and the application of RUVIS technology method used for capturing and locating finger mark impressions present on post blast materials.

A research article published by **T.P.B. Larkin, N.P. Marsh, P.M. Larrigan entitled 'Using liquid latex to remove soot to facilitate fingerprint and bloodstain examination: A case study'** discussed the liquid latex technique for the soot removal from surfaces to reveal and recover fingerprints and bloodstains at a homicide scene. Liquid latex is quick, cheap and productive method for the removal of soot without disturbing other forensic investigations.

Conclusion:

Latent fingerprints are one of the most common types of evidence found at a crime scene but needs to be properly located, developed, collected, preserved, and examined for the identification purposes. Despite the advancements and techniques available, latent print recovery remains a challenging task and when it comes for the recovery and collection of fingerprints from destructive crime scene like- fire, arson, bomb blast, explosion are the most neglected ones. The presence of excessive heat, electromagnetic radiations, smoke tends to destruct the latent prints. So, researches were conducted to clear the misconception, that if proper methods and techniques used than the recovery, collection, development of latent prints are possible from destructed crime scenes. The research in this field have concluded proper soot removal techniques like- application of liquid latex, NaOH wash solution, brushing, tape lifting leads to the visibility of latent prints. The researches also concluded that soot somehow helps in protecting the latent prints from damage due to prolonged exposure to high temperature and heat and for the enhancement of latent finger marks methods used are- aluminium and dye, wet powder suspension, black magnetic are useful. In case of instrumental techniques Reflected Ultraviolet Imaging System (RUVIS) and GC-MS shows better results in the amino acids in the residue of fingerprints for the development. These studies have shown that proper techniques and methods results recovery and development of latent fingerprints from destructive crime scenes.

Discussion:

Apart from the researches being conducted there are still unawareness among the investigators when it comes for the recovery and collection of evidence like fingerprints from post fire, explosion crime scenes. There are still some areas left unmarked and undetected for examination of evidences from the destructive crime scenes. Also, the techniques for the development of latent fingerprints on non-porous surfaces are still need to be more structured and stronger. Techniques like silver metal deposition and small particle reagent need to be more developed for the better enhancement of latent prints. The more technologies like RUVIS and GC-MS need to be explored. Also, the study needs to be explored. There are many more researches need to come up for effectual locating and recovery of latent fingerprints from destructive crime scenes.

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