

Subject	Forensic Science
Paper No and Title	Paper 7 : Criminalistics and Forensic Physics
TOPIC	Tool Marks
Module No.	FSC_P7_M12

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1. Learning Outcomes

In this module, you shall be able to learn about

- The tools marks and their characteristics
- Types of tool marks
- Matching of tool marks

2. Introduction

Tool marks are the impressions left by a tool on coming in contact with a surface. These tool marks show different types of characteristics depending on the type of impression, its shape and how the mark was created. Depending upon the force with which the marks have been put, the tool marks are divided into different categories. The examination of tool marks is an important factor in the field of criminalistics as it can directly establish the link between a tool mark and the tool that created it. These impressions also help to reconstruct the crime scene.

3. Tool marks - Definition

A tool is a hard object which when forcefully comes into contact with another object, leaves a mark on the softer one like a screw driver, plier or an arcjoint plier, hammer and wire cutters etc.

A tool mark is defined as an impression left by a tool when it comes into contact with a surface. If the tool contacts the surface with a large force, it leaves behind an indentation and the pattern of the tool is permanently reproduced on the surface. These marks play a very vital role in forensic science as the criminals have a tendency to use tools for committing burglaries or other heinous crimes such as cold blooded murders. For example, if a burglar tries to enter a house by breaking the lock with the help of a screw driver, the marks left by the tool are a direct evidence of the presence of that tool at the crime scene. But, if the tool is found with a suspect or even near the suspect, it provides a direct link between the suspect and the crime scene.

In the field of forensic science, the tool marks can either take the form of negative impressions or an abrasion or both.

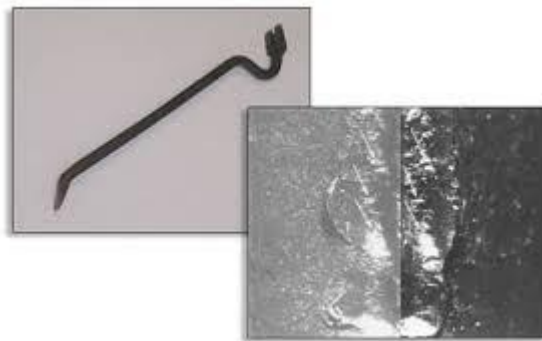


Fig 1. Tool and tool marks

4. Characteristics of tool marks

Tool marks have two different kinds of characteristics:

Class and Individual

- ***Class characteristics:***

These types of characteristics of a tool mark include the type of impression, its general shape and dimensions. These characteristics are typically the broad characteristics from which the crime investigator can determine what type of tool created the impression and how was it created. But, this does not serve the purpose of the identification of the exact tool that actually created the mark. Thus, if only the class characteristics would have been available, then it would not have been possible to distinguish which tool among a pack of similar tools made an impression. For this, individual characteristics are taken into consideration.

- ***Individual characteristics:***

Individual characteristics are microscopic characteristics, which refer to the small, peculiar features exhibited by the tool that are individual to one particular tool. These characteristics include small, microscopic ridges and irregularities present on the tool itself. For example, the tip of a screw driver is never exactly flat but has irregularities near its edge. These characteristics are created by the use and misuse of the tool, its cleaning and maintenance. These characteristics actually permit a formal identification. If such characteristics are available on a tool mark, then it is possible to identify the tool that was used in committing the crime, even among a series of identical tools.

5. Types of tool marks

Depending on the force with which a tool comes in contact with a softer surface, Tool marks are divided into two different categories.

- ***Impressed tool marks:***

These marks occur when the surface onto which the tool comes in contact with, is softer in comparison. When the tool comes in contact with the object (softer than the tool) with a huge force in a motion perpendicular to the plane of the surface leaving an impression on the surface, such tool marks are called impressed tool marks. There is no lateral motion. At the crime scene, the unique imperfections of the tools are transferred to the surface that make possible a positive identification of the tool involved in the crime.

As an example, when a tool like a screw driver is used by the criminal to forcefully intend a metal surface without penetrating, then the impressions it leave will be helpful in identifying the tool.



*Fig2. Tool marks by an arc joint plier
(Impressed tool marks)*

- ***Striated Tool marks:***

These marks are produced when the tool contacts an object with lateral or sideways force. In such a case, the tool is placed against an object and is moved parallel to the object or across the object.

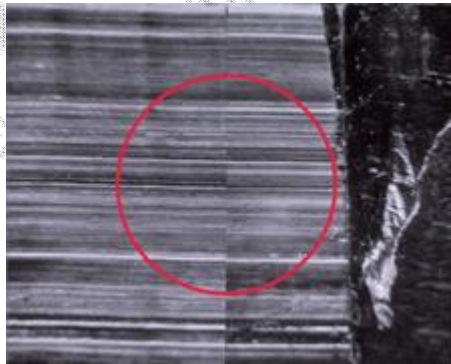


Fig 3: striated marks

Some tool marks can be a combination of the above two types.

6. Examples of types of evidence submitted in tool marks case:

Types of evidence submitted in tool marks cases include tools like

- Bolt cutters
- Screwdrivers and chisels
- Scissors
- Knives and box cutters
- Pliers and wrenches
- Crowbars tire irons
- Saws and hammers



Fig 4: Different types of tools

7. Examples of places and surfaces where tool marks can be observed during investigation:

Some of the places and surfaces where tool marks are likely to be found during investigation are:

- Wire, chains
- Door and window frames
- Sections of metal sheets
- Safes
- Human bone or a cartilage
- Padlocks and door knobs
- Bolts and locks etc.



Fig 5: Different types of surfaces where tool marks can be found

8. Examination and matching of tool marks:

Examination and comparison of the tool marks from a crime scene with the tool marks of the actual suspect tool can act as an important and invaluable evidence in linking the suspect to a particular crime and thus the case can be concluded.

The major precautions that are to be taken while examining the tool marks:

- Door and windows and other openings with handles or locks at the crime scene should not be touched if they are broken or the locks are cut, lest the tool marks or the finger prints are destroyed.
- A tool should not be fitted forcibly into the impression which may affect the laboratory analysis.
- The tool marks should be documented completely including sketches and photographs before removing.
- If any trace evidence is found on the tool marks, the examination of the trace evidence should be done prior to tool marks examination.
- Tool marks evidence should be packaged so that it is not damaged as it may change the microscopic characteristics.
- If the tools are stained with blood or some other biological material, then that has to be cleaned using a soft bristle brush and disinfectants like Terg-A-Zyme, ethanol etc.
- The tools are always cleaned with a cotton tipped swabs saturated with ethanol or acetone.

The tool mark examination and matching consists of different phases:

- The first step is to observe some physical features of the tool :
 - Manufacturer
 - Type of tool
 - Composition and color
 - Condition of tool's finish
 - Dimensions of the tool (overall length, width etc)
 - Any irregularity at the ends of the tool
- The next step is to observe the physical features of the tool marks:
 - The type of the tool mark
 - Width or diameter of the tool mark
 - Type of cutting motion by the tool
 - Direction of motion of the tool that created the tool mark
 - Position of the tool mark on the tool



Fig 6: Examination of tool marks in the laboratory

- A photograph of the impression made by the tool is taken which provides a permanent record of some of the characteristics of the tool mark.
- If the carrier or the object where the tool mark is located, cannot be collected as an evidence then a cast of the tool mark is made with a dental paste.
- After discovering the tool, if its class characteristics match with those exhibited by the tool mark under consideration, then the comparison process is started.
- The tool is observed and a photograph is taken and then the comparison tool marks are made of a softer surface.
- The comparison is then done between the comparison tool marks and the tool marks under investigation using a comparison microscope which consists of two microscopes connected with each other with which two objects can be viewed simultaneously with the same degree of magnification or a stereomicroscope.
- If a match exists then the common origin between the two tool marks is established which then leads to a conclusive report of the case.

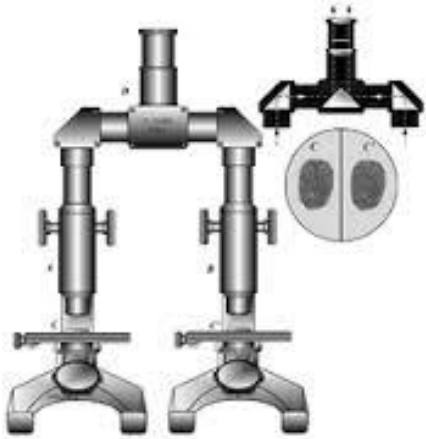


Fig 7: comparison microscope



Fig 8: Stereomicroscope

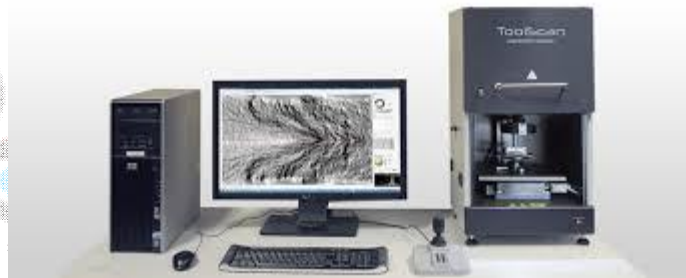


Fig 9: comparison process in the laboratory

9. Summary

To summarize, the tool marks which are the impressions left by a tool at the crime scene play a vital role in discovering and identifying the tool used to commit the crime by comparison processes. These tool marks have to be documented carefully and completely including the physical features of the tool and tool marks, lest some information is destroyed. The tools under examination should also be cleaned with soft cloth dipped in ethanol. The examination process is carried by comparison microscope and stereomicroscope.

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