



PH2001: การสืบสวนรอยจากที่วางแบบแผ่นโลหะบางบนลูกธนูที่ยิงโดยคันธนูตกกำลัง
Investigation of rest mark from blade launcher rest on the arrow shot by compound bow

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Abstract

Nowadays, the usage of arrow and bow has been greatly deviated from its normal functions like hunting and sporting tools. They are increasingly found to be misused as killing weapons and drug delivery tools in many places around the world including Thailand. In such cases, an arrow found in a crime scene is expected to contain a vital clue for an investigator to match the evidence with the launching bow or even the shooter. The investigation conducted for the matching arrow and bow is based on the tool mark analysis similar to what is normally conducted in the ballistic investigation. In this study, rest marks left on a shot arrow by a blade launcher from a compound bow is studied. Carefully examination on the patterns of rest marks by different methods such as naked eyes, stereomicroscope and comparison microscope are performed. Although the observation obtained hardly reveals the link of an arrow with its origin, the unique impression on an arrow can certainly be used to eliminate unrelated evidences found in the investigation.

KEY WORDS: Archery, Bow, Arrow, Characteristic, Mark

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Introduction

Nowadays, most crimes are committed with weapons such as knife, bat or firearms. Criminals use weapons to threaten a victim to follow their commands. The worst case of using the weapon to commit crimes is to kill the victim. Sometimes this happens accidentally but mostly occurs intentionally. Forensic scientists have many ways to prove whether the weapons was used in the crime. Each type of weapons has its own characteristics that can lead the scientist or investigator to the circumstance that really happened. If the weapon is an arrow shot by a bow, the wound characteristic on a person inflicted by the arrow is normally similar to the ones made by a knife. This is not hard to imagine that the equipment has a capability to be used as a weapon to kill people. If so, what forensic scientist can do? Do they have any method to prove the origin or the owner of the suspected arrow?

In this study, a compound bow () is used. A normal procedure before shooting is to place the shaft of an arrow on the blade launcher rest (). When shooting, the arrow is quickly released and pushed forward by the bow string. As the arrow slides past the launch rest, the contact between them causes characteristic scars called rest mark on the arrow shaft. The impressions on the arrow shaft are expected to provide an important link between the shot arrow and the launch rest attached to a compound bow

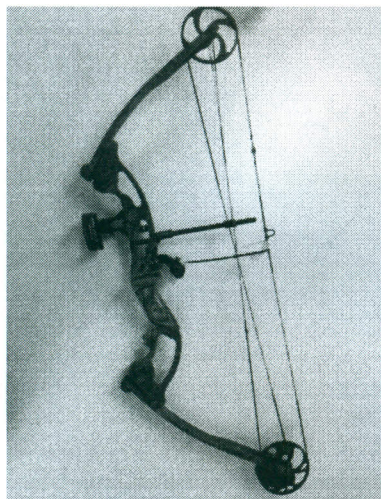


Figure1: The image of compound bow

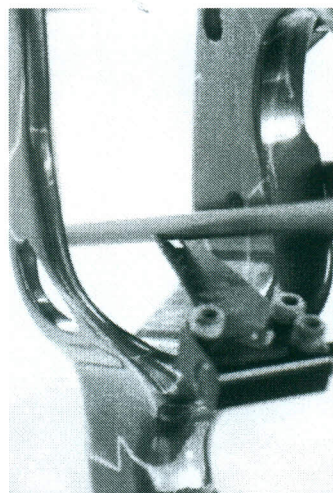


Figure2: The image of arrow on the blade launcher rest



Objectives of this study include

1. Study the proper ways to search mark on the arrow.
2. Study a proper method to enhance rest marks on the arrow for higher clarity.
3. Study the dimension of the arrow rest for comparison with the rest marks.

Material and Method used in this study are composed of

1. A new dozen of arrow
2. Compound bow
3. Stereo Microscope with image capture unit
4. Computer with image enhancing software (Adobe Photoshop CS3)
5. New and used arrow blade launcher rests
6. Used arrows from various archer for comparison

Procedures

First of all, rest marks were generated on new arrows by shooting with a compound bow. Shot arrows were divided into 5 groups based on different shooting times that (0, 1, 5, 10, 15, and 45). Secondly, the rest marks on the shot were examined with naked eyes and their picture were taken. After that, the oblique light technique was applied and again their picture were taken. Photos from both steps were compared. In addition, an image enhancing software was applied. The parameter that uses to enhance includes the light correction for photography. Comparison was made between enhanced and non enhanced images. A quantitative investigation was also performed by comparing the dimension of the arrow rest to the rest marks on the arrow shaft. In the last step, the questioned arrow was presented to the professional toolmark examiner for comments and suggestions.

Results

1. Rest mark Generation and Search

One arrow was taken out from a collection of arrow with the same brand and catch and kept as a control sample without being used. The rest marks can be seen by naked eyes on the arrow shafts at least 15 shooting times. A clearer observation can be achieved when the oblique light technique was applied.

Table1 shows the group of arrows divided by shooting times

Arrow Number	Shot time(s)	Group
Control	0	Control
1	1	1
2	5	x 2
3	5	
4	10	x 3
5	10	
6	15	x x 4
7	15	
8	15	
9	45	x x 5
10	45	
11	45	

2. Rest mark enhancing

Apart from examining the rest marks by naked eyes, a stereo microscope with image capture unit was used. The digital photos of rest marks were taken in this step. The photos were digitally enhanced by computer software (Adobe Photoshop CS3). Figure 3 shows a higher clarity of the rest mark on the arrow shaft obtained from enhanced image,

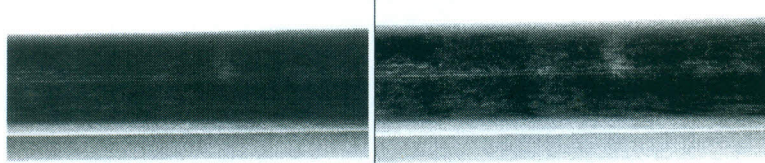


Figure 3 : The comparison of non-enhanced and enhanced image. The rest mark on the arrow shaft can be observed clearly from enhanced image.

3. Origin of rest mark confirmation

After examining the rest marks on arrow shafts by imaging, Dimensions including angle and length of the blade launcher rest was measured and compared to the marks on the arrow shaft. Note that contact area on the arrow rest can the size of the arrow that is mostly used with a particular bow.

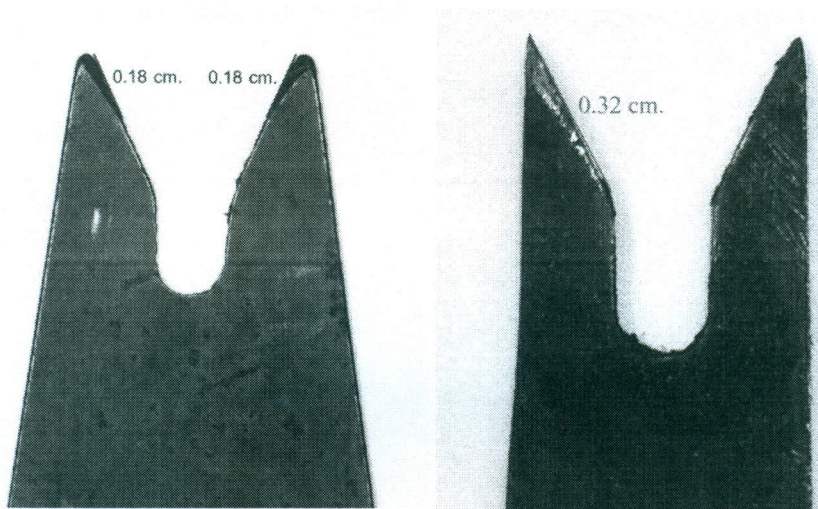


Figure 4 : Images of unknown and known arrow rest show the different sizes of damage areas that can impress on an arrow.

Conclusion

Rest marks on arrow shafts can be seen by naked eyes after being shot at least 15 times. More details of rest marks can be observed with an image enhancing software. Experimental results indicate that such unique patterns of rest mark on the arrow shaft can link to a particular origin which in this case, is a compound bow with a blade launcher rest. In addition, the contact area of the rest can reveal the size of the arrows used with that bow. This also helps to confine the suspect too.

The professional toolmark examiner comment on this work is "Rest marks on the arrow may not provide the individual characteristic to link with the origin. By the way, the restmark can provide class characteristic that can eliminate unrelated evidence that shown in the investigation" This comment indicates that rest marks on the arrow shafts are essential in the forensic investigation.

Discussion

The rest marks on the arrow shafts can be seen but can not completely distinguish each bow characteristic. The investigation still required other source of information such as customer record from place of purchasing and eye witnesses at the time of incident. The arrow size obtained from the rest marks is only an approximation. Again, other source of information are still required.

Suggestion