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Original Article

Toothpaste Pattern: A Distinctive Feature of an 8 mm Bullet Fired through a Glass Target

CrossMark

نمط معجون الأسنان: السمة المميزة لرصاصة عيار ٨ ملم مرت من خلال هدف زجاجي

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Abstract

Shooting cases studied at the crime scene reveal an interesting outcome: the components of a projectile are usually disconnected and separated after firing through intermediate targets such as glass, bakelite or any other brittle materials.

This study reports the forensic analysis of an 8mm soft nose bullet fired through a standard .315" sporting rifle onto glass sheets. Typical toothpaste pattern, mushroomed inward lead core was obtained in the laboratory for examinations. It is further highlighted that the lead core and jacketed portion of bullets were found separated in the cotton filled bullet recovery box after being fired through the glass targets. In such situations, interpretation and correlation of these elements becomes a difficult task for the firearm examiner or crime scene investigator.

In the present study, typical toothpaste type patterns of the lead core of Indian manufactured 8mm soft nose bullets were forensically examined and analyzed. Experimental data reported in this study may be helpful for firearm experts, crime scene investigators and related investigating agencies in future to correlate and interpret the evidence found at a shooting scenes

Keywords: *Forensic Science, Sporting Rifle, Soft Nose Bullet, Glass Target, Toothpaste Pattern.*

المستخلص

تكشف حالات إطلاق النار التي درست في مسرح الجريمة عن نتائج مثيرة للاهتمام: فعادة ما تنفصل مكونات القذيفة وتنقسم بعد إطلاق النار أثناء مرورها من خلال أهداف وسيطة مثل الزجاج أو الباكليت أو أي مواد أخرى هشة.

قامت هذه الدراسة بعمل تقرير عن التحليل العلمي لرصاصة (ذات الرأس اللين) وحجمها ٨ ملم أطلقت من خلال بندقية رياضية عيار ٣١٥ على صفائح زجاجية. تم الحصول على نمط معجون الأسنان النموذجي، خلال الفحوص المعملية على النواة الرئيسية الداخلية للرصاص على شكل فطر (مشروم). ومن الجدير بالذكر أيضاً أنه تم العثور على الجزء الأساسي من الرصاص الذي تم فصله من الرصاصات في صندوق استعادة الرصاصات المملوء بالقطن بعد إطلاقه من خلال الأهداف الزجاجية. وفي مثل هذه الحالات، يصبح تفسير وارتباط هذه العناصر مهمة صعبة بالنسبة لفاحص الأسلحة النارية أو مدير مسرح الجريمة.

في هذه الدراسة، تم فحص وتحليل أنماط معجون الأسنان النموذجية للب الرصاص (المصنع في الهند) من عيار ٨ ملم من الرصاص ذو الرأس اللين. وقد تكون البيانات التجريبية المسجلة في هذه الدراسة مفيدة لخبراء الأسلحة النارية ومديري مسرح الجريمة ووكالات التحقيق في المستقبل لربط وتفسير الأدلة الموجودة في مسرح الجريمة.

الكلمات المفتاحية: علوم الأدلة الجنائية، بندقية رياضية، رصاص ذو الرأس اللينة، الهدف الزجاجي، نمط معجون الأسنان.

Production and hosting by NAUSS

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1. Introduction

At the crime scene, firearm experts are often asked to determine the range of firing, penetration of bullets, types of bullet, caliber of bullet and through which firearm a bullet was fired, etc. The first study on projectile entry angle was done by Cashman [1]. The firearm examiner may compare the test-fired bullets directly with the questioned bullets, whose type and behavior are to be determined. Licensed firearms such as sporting rifles and ammunition may be acquired by criminals and are thus frequently involved in criminal cases. Sanow discovered that high velocity/energy rifle bullets were severely affected by tempered glass [2]. The perforation effect of .303", .32", .38" and .22" caliber firearms on commercial glass sheets have been studied. The forensic interpretation and process of annealed glass fracture are explained by Steven P. Mcjunkins & John I.Thornton [3]. The perforation craters always have a well-defined shape with a more or less constant semi angle which is independent of the projectile caliber, velocity and thickness of the target. Study of unusual damage to the window glass plate has been investigated by Frye [4].

In general, the examination becomes easy for the firearm examiner when the bullets are intact and not in a deformed, distorted or mutilated condition. When some portions of the bullet such as missing jacket, lead/lead core, priming compositions, wads, etc., are collected from the crime scene or recovered from the body of the victims or targets, identification of these components becomes significant. The behavior of glass under impact and static loading has been thoroughly highlighted by Howard [5]. Many studies have been conducted into different projectiles on different targets by ammunitions of Indian as well as foreign origin, employing well-known techniques and targets. However, no study has been conducted on soft nose bullets fired through a high velocity rifle onto a glass sheet. An attempt was made to evaluate the degree of bullet deflection produced by only 1/8-inch tempered glass by Stahl et al. [6]. A review of the available literature shows that comprehensive studies on various ballistic tests have been made in the past, but these were mostly due to linkage of bullets from crime scenes with test bullets. The crack on impact side of glass sheet propagate define trajectory just as in case of Hartzjain conical fracture. Harper proposed to explore the effects of 3/32" and ¼" plate glass, together with automotive safety glass on trajectory of .38 caliber led, .38 caliber metal cased and .357 caliber metal piercing tip ammunition [7]. The remaining velocity of a bullet fired through a glass plate was estimated by Jauhari et al. [8]. A considerable difference and modified the basic values of various parameters of projectiles as reported by Hatcher [9]. Forensic examination of glass fracture was explained by Thronton & Cashman [10]. The wounding potential of a .315"/8mm soft nose bullet fired through glass sheets was studied by Waghmare et al. [11]. Statistical analysis of a soft nose bullet fired onto a window pane was also explained by Waghmare et al [12]. The basic principles and practical aspects of forensic ballistics has been described by Saferstein [13]. The study of forensic ballistics such as internal, external and terminal ballistics, tool marks identification, shooter identification and range estimation has been highlighted by Heard [14]. The phenomena of penetration of semi jacketed bullets fired onto an ordinary window glass pane with different thickness available in India has been studied. Few research work on phenomenon attending flight of .315"/8mm bullet fired through glass targets have been experimentally explained by Waghmare et al [15].

In the present study, the behavior and typical pattern of lead core fired through a glass target has been discussed.

2. Materials and Methods

For scientific investigation, laboratory experiments were carried out with a 8 mm soft nose bullet fired through a .315"/8mm high velocity sporting rifle with respective ammunition manufactured in the Kirkee Factory, India.

Commercial uncoated borosilicate glass sheets easily available in the open market measuring one foot by one foot in dimension were used as the target. Specific manufacturers of glass sheets were not chosen for test firing. Figures 1 and 2 indicate the 8mm cartridge and its components, respectively. The glass sheet was kept at a right angle to the muzzle end of gun, which was fixed on a heavy wooden table. The firing arrangement was made in such a way that the glass target could be easily fixed and removed for the next firing. The distance between the muzzle end of the firearm and the glass targets was kept constant at about 4.5 meters. The firing was done with .315”/8mm soft nose bullets with an approximate muzzle velocity of 1970 ft/sec on different thicknesses of glass sheet. Typical toothpaste pattern of lead core and jacketed portions was recovered in rolled absorbent cotton after passing through the glass sheets, to ascertain whether the resistance of the glass plate led to any fragmentation or distortion of the soft nose bullet or not. About 18 cartridges were fired through the glass sheets. Table-1 indicates the various parameters of standard and fired 8mm soft nose bullets.

3. Results and Discussion

In the present experiment, the heavy weighted lead core was found far ahead in the bullet recovery box as compared to its full or partially fragmented jacketed portion. This may be due to center of gravity, hence the energy lost by the lead core is more than the jacketed portions. A typical toothpaste patterned shape of lead core with mushroom shape bent at the middle portion was also seen. Fig. 3 & 4 show the toothpaste pattern of the 8mm soft nose bullet. This type of phenomena may be formed as soon as the soft nose bullet, especially lead core bullets, penetrate brittle target materials such as glass sheets. This type of phenomena may occur as soon as the soft nose bullet, specially lead core penetrate brittle targets such as glass sheets, it happens as the glass targets tries to oppose the resistance of the lead core. As a result, it loses its maximum amount of kinetic energy to penetrate the glass target and the shape of the lead core then develops the toothpaste pattern. It was also observed that during the perforation of the bullet in the glass target, fine sharp edges of glass particles moved backwards with high speed. This shape of toothpaste pattern is unique in nature and only observed when 8mm soft nose bullets are fired through glass sheets using a high velocity 0.315” sporting rifle. Hence, the crime scene, firearm expert, investigating officer and glass examiner should be aware about the shape of projectiles after passing through the various brittle and solid targets. In cases of shooting incidents through glass targets, the present study may be useful to future forensic investigations. It is pertinent to mention that the few glass sheets were broken into small pieces and felled down after being hit by high velocity soft nose bullets. However, a few photographs of holes on glass sheets produced by 8mm soft nose bullet are provided (Figure-5).

Main parameters of soft nose bullets revealed that the maximum impact energy is utilized while passing through a glass sheet. Table-1 shows that the standard weight of the bullet, lead core, and length of jacketed portion completely changed. This may be due to the loss of kinetic energy into the glass target. Experimental observations also revealed that the thickness of glass and distance of firing from muzzle end to glass target doesn’t matter due to the high spinning rate of the soft nose bullet. The 8mm bullet was manually separated from the cartridge, and the total weight of bullet, jacket, and lead core was taken as a standard for comparing with the experimental behavior of the bullets (Figure-3). When a soft nose bullet fired through glass target by .315” sporting rifle, a typical mushroomed shape of lead core bent at middle portion was observed.

Figure 1- *Complete photograph of 8mm Cartridge*.

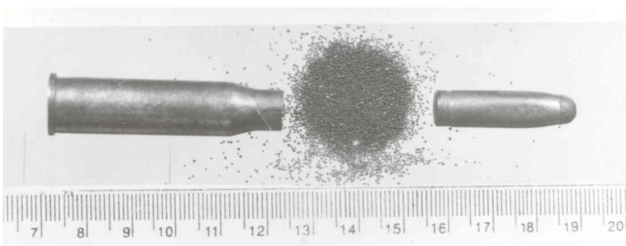

Figure 2- *Complete photograph of components of 8mm bullet*.

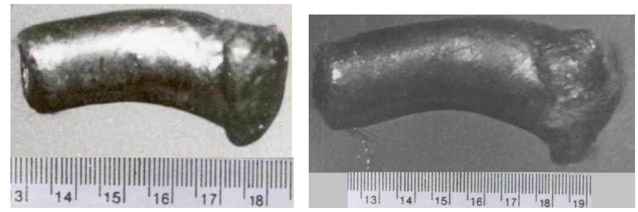

Figure 3- *Photograph showing hard lead core with mushroom inwards with bent at middle of the core)*

Figure 4- *Photograph showing hard lead core with target material adhered to mushroomed core*.

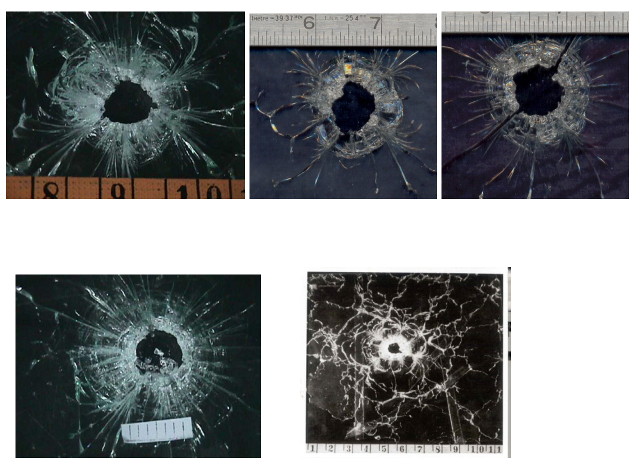

Figure 5- *Photographs showing holes produced by 8mm soft nose bullet fired through glass sheets*.

Conflict of interest

There is no conflict of interest.

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Authors have not taken any fund for this project from any other agencies.

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Table 1- *Dimensions of standard and fired bullets.*

a. Standard weight of 8mm bullet: 239.2 grain (15.49 grams).

b. Standard length of jacketed portion: 27.8mm.

c. Standard length of core at nose: 30.9mm.

d. Distance between glass sheet and firearm: 4.50 Meters

Sr. No	Thickness of glass sheets (mm)	Weight of fired bullet (grams)	Wt. fired lead core (grams)	Diameter of fired lead Core (mm)	Length of lead core (mm)	Difference of standard length of lead core and recovered lead core(mm)	Type of deformation increase/ Decreasse of lead core
1.	2	14.39	12.55	7.12	23.55	7.35	Decreased
2.	2	14.47	10.90	6.85	17.20	13.70	Decreased
3.	2	14.40	12.60	6.89	22.19	8.71	Decreased
4.	4	14.59	12.09	7.26	26.35	4.55	Decreased
5.	4	15.32	13.30	7.49	24.36	6.54	Decreased
6.	4	13.11	11.54	6.63	23.43	7.47	Decreased
7.	6	13.42	12.14	7.56	21.99	8.91	Decreased
8.	6	13.45	11.15	7.24	10.10	20.80	Decreased
9.	6	13.01	11.72	6.83	24.00	6.90	Decreased
10.	8	12.90	12.09	4.70	34.21	-3.31	Increased
11.	8	14.31	12.10	6.23	34.32	-3.42	Increased
12.	8	14.42	12.11	7.65	24.10	6.80	Decreased
13.	10	14.61	6.50	5.81	20.23	10.67	Decreased
14.	10	13.75	11.25	5.79	15.81	15.09	Decreased
15.	10	14.21	11.99	7.39	18.35	12.55	Decreased
16.	12	12.96	11.40	7.89	19.67	11.23	Decreased
17.	12	13.37	10.78	7.49	19.55	11.35	Decreased
18.	12	14.79	9.84	7.43	22.10	8.80	Decreased
S.D.	-	0.73	1.46	0.81	5.76	5.77	Decreased

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