GUNSHOT-RELATED DISPLACEMENT OF SKIN PARTICLES AND BACTERIA FROM THE EXIT REGION BACK INTO THE BULLET PATH.

Int J Legal Med (2007) 121:105–111DOI 10.1007/s00414-006-0107-9

การศึกษาเส้นทางลูกกระสุนปืน เกี่ยวข้องกับ การเข้าแทนที่ของอนุภาคผิวหนัง และแบคทีเรียจากทางออกในส่วนที่ย้อนกลับของเส้นทางลูกกระสุนปืน

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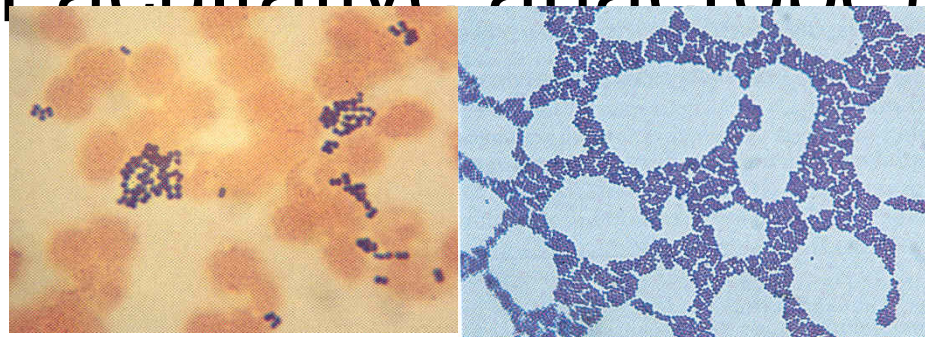
Introduction

- Gunshot exit wound

Intro(cont.)

- Normal flora *(Staphylococcus epidermidis)*
  - Family: Micrococcaceae
  - Genus: Staphylococcus
  - Gram positive cocci
  - 35-37 ^{o}C (Facultative anaerobe)



Materials and methods

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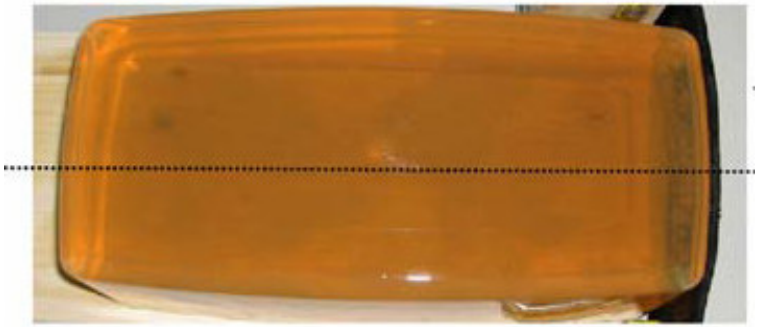
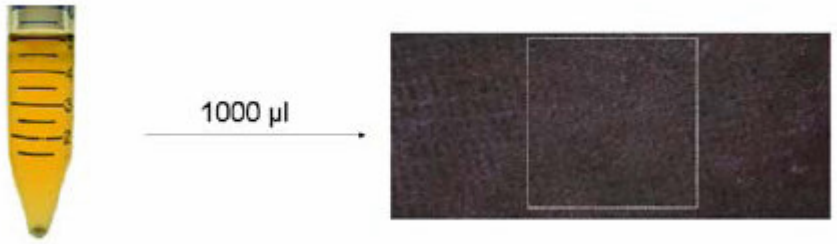
- Experimental set-up

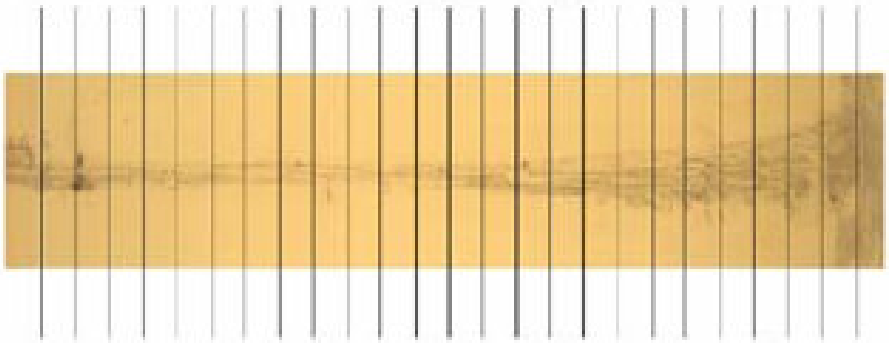


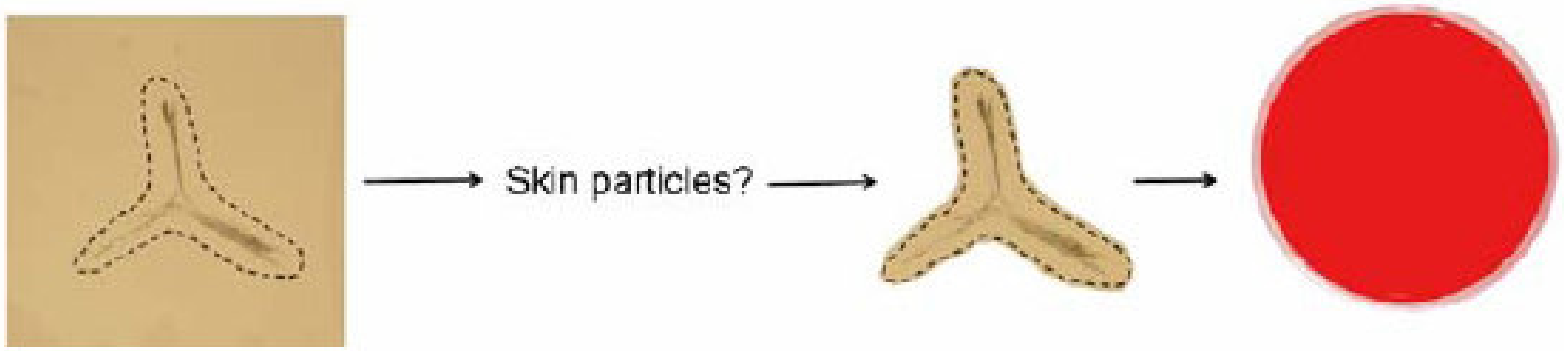
26×12×12 cm



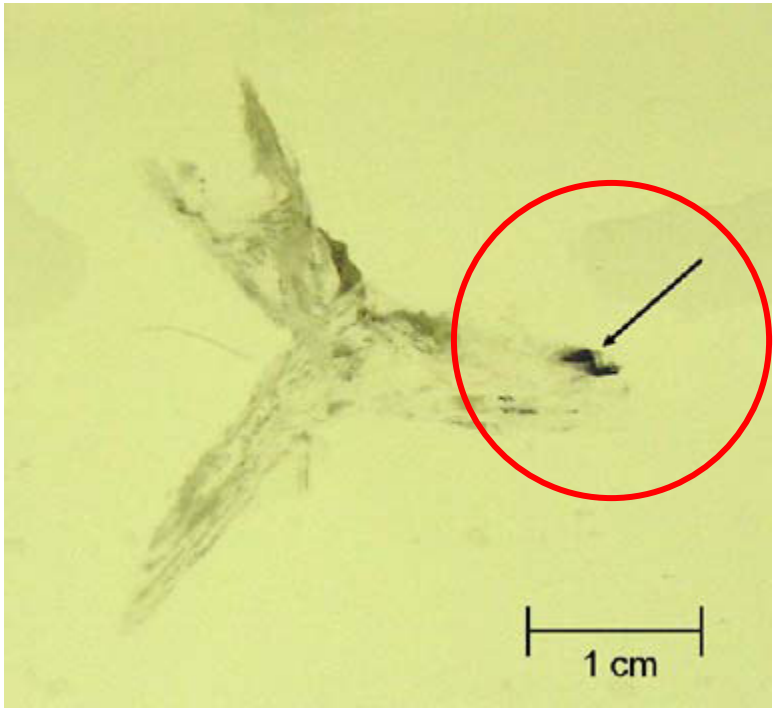
Materials and methods

Method(cont.)

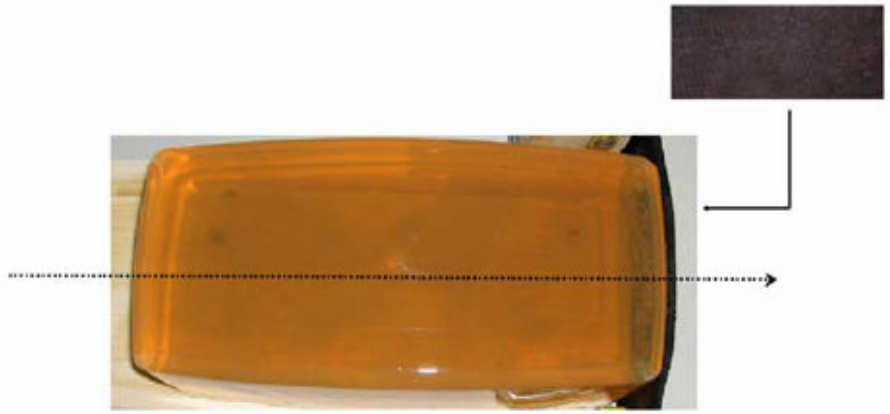




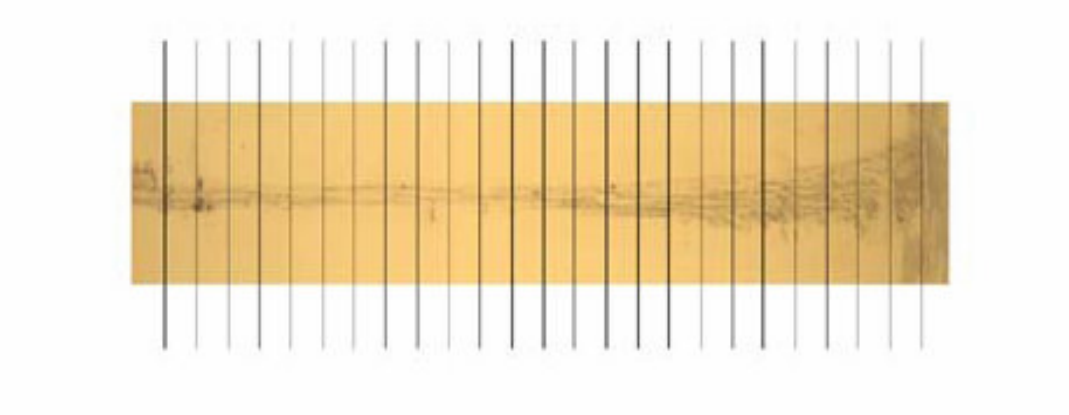
Main test series with Staphylococcus epidermidis

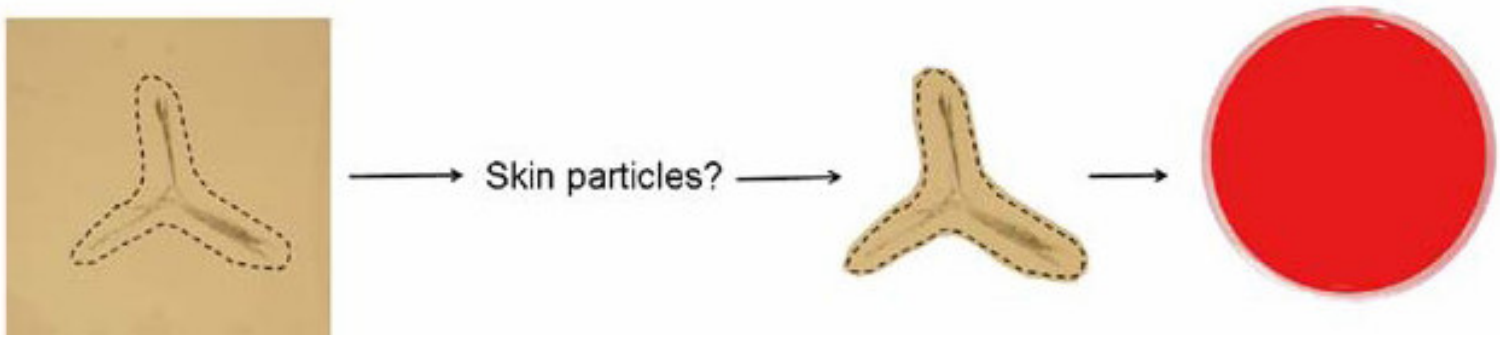


Main test series with Staphylococcus epidermidis



Nine pieces of pig skin, each measuring 25×10 cm, were stained in a haematoxylin bath




Skin particles?

Results

Preliminary test for bacterial growth

After laminating the 26-cm-long block and cutting out the gelatin

Cultures were incubated for 24,48 hr.

Growth of GFP-labelled bacterial colonies

Demonstrated by fluorescence microscopy

No contaminating microorganisms were found

Distribution of macroscopically visible skin particles along the bullet

Table 1 Ammunition data of the cartridges used for test shots

Number of shots	Bullet shape	Abbreviation	Bullet type	Bullet mass (g)	Bullet velocity (m/s)	Bullet energy (J)	Manufacturer
6	Round nose	(r n 1–5)	Lead bullet	10.2	226–249	260–316	Winchester
1	Truncated cone	(tc)	Semi-jacketed bullet	7.45	278	288	Winchester
1	Hollow point	(hp)	Semi-jacketed bullet	8.1	314	399	Remington
1	Flat nose	(fn)	Lead bullet	9.6	221	234	Remington

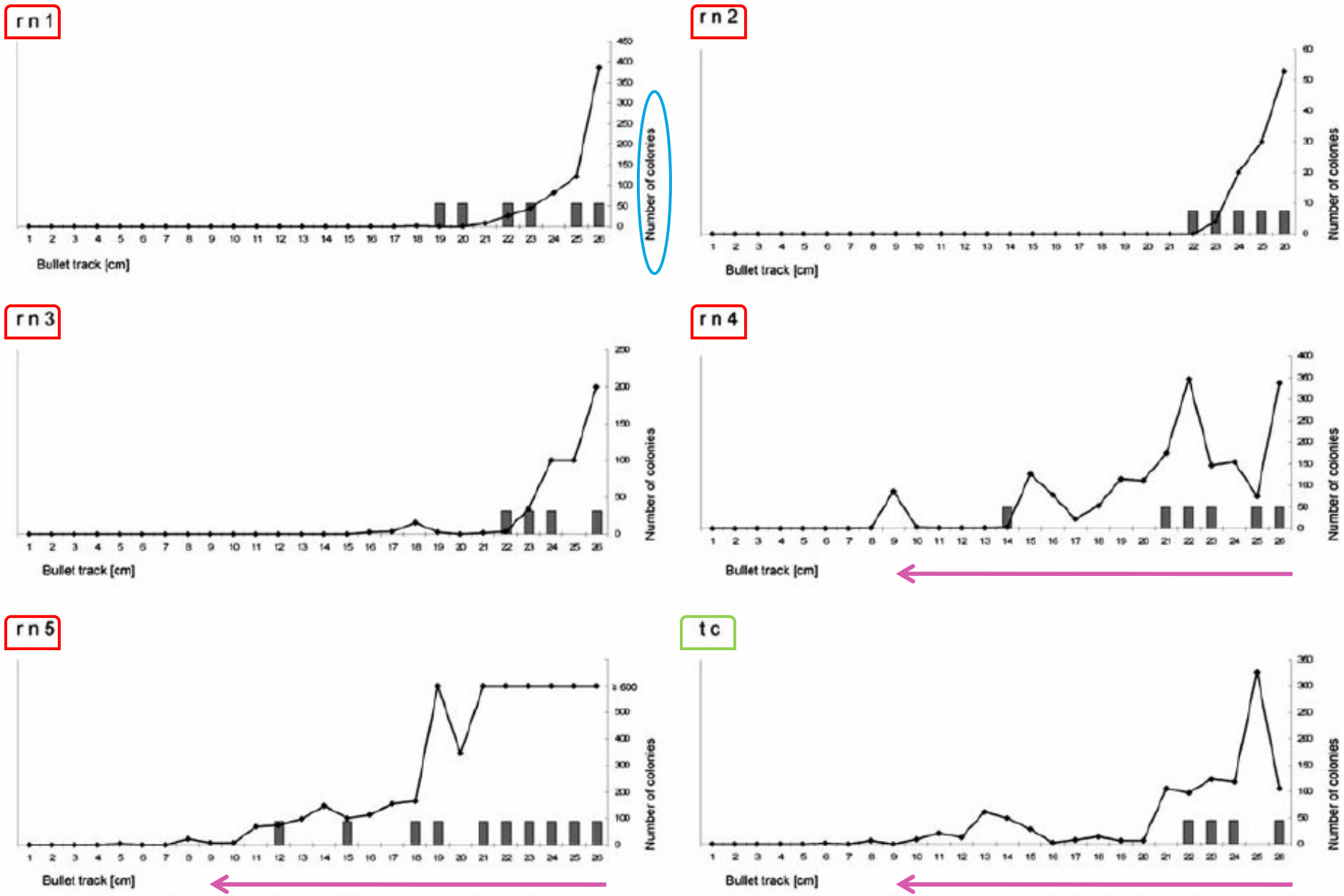
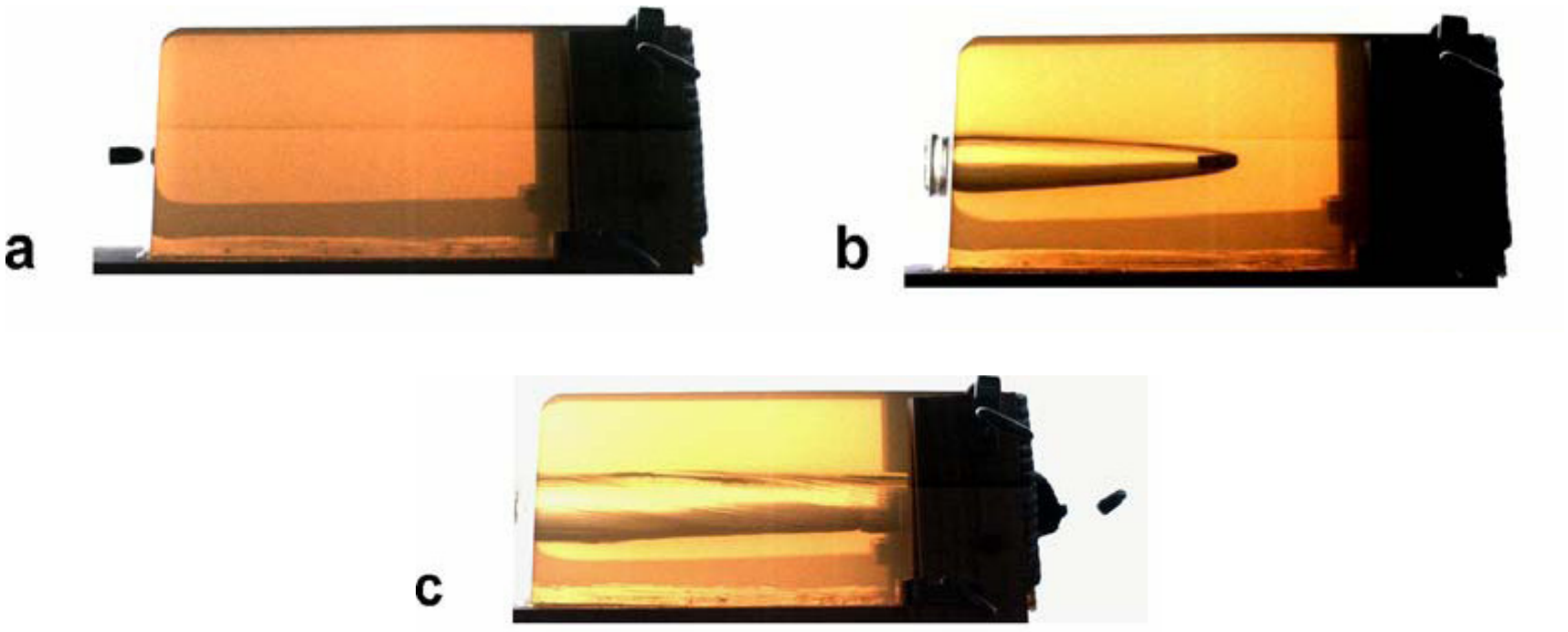


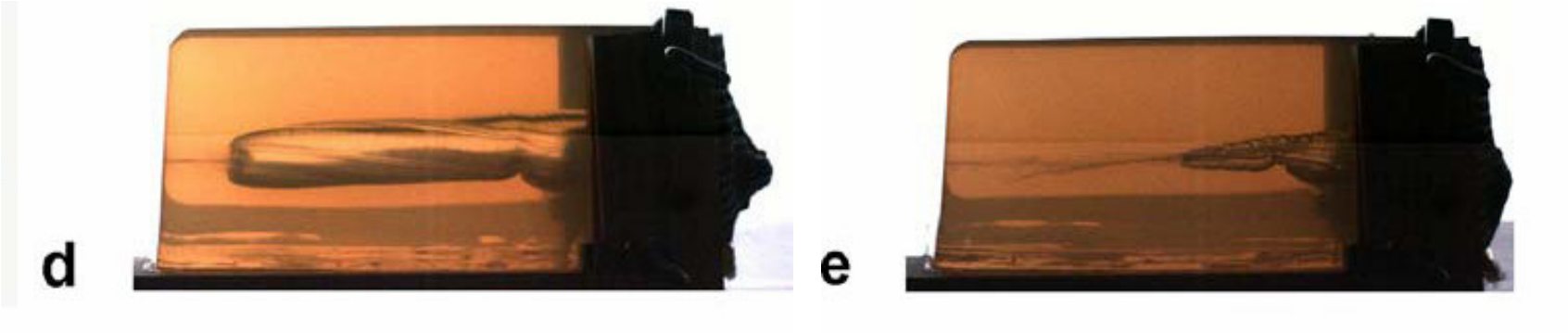
Fig. 2 Comparative illustration of skin particle distribution in the bullet tracks (*grey bars*) and number of bacterial colonies (*black rhombi*)

High-speed motion camera documentation of test shot (r n 1)



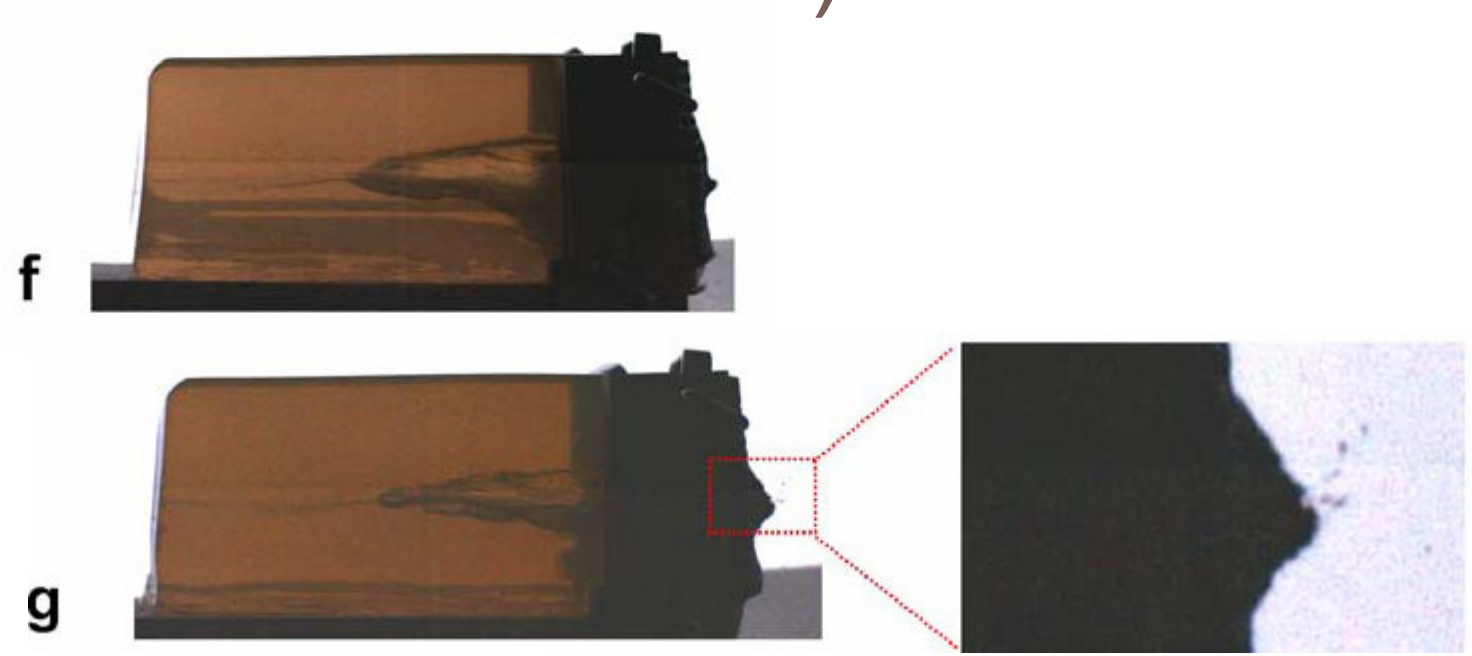
a–c Formation of the temporary cavity

High-speed motion camera documentation of test shot (r n 1)



d, e partial collapse of the temporary cavity in an anterograde direction

High-speed motion camera documentation of test shot (r n 1)



f, g pulsation of the temporary cavity and expulsion of skin particles (detail)

Discussion

- In a previous study it was shown that local contamination of gunshot tracks can be caused by an anterograde displacement of skin bacteria from the entrance region

Discussion

- With our experiments we clearly show that bacteria applied to the skin on the exit site of a composite model were displaced in a retrograde direction back into the bullet path.

Discussion

- The preliminary test was performed to unambiguously identify bacteria within the wound track as being those previously applied to the pig skin on the bullet exit site.

Discussion

- UV-fluorescent GFP-labelled bacteria could be detected in the posterior 10 cm of the bullet track.
- There was no growth of contaminating microorganisms on the ampicillin-containing LB agar.

Discussion

- In the six through-and-through gunshots with the round-nose lead bullets and the truncated cone bullet, were able to detect *S. epidermidis* in the last 6–8 cm of the bullet tracks, and up to a distance of 15–18 cm from the exit site in three out of six cases.

- The high-speed motion camera documentation

Discussion

- The cartridges used in this study were chosen in accordance with our previous studies
- Further studies with a larger number of test shots and additional types of cartridges, especially those carrying full metal jacketed bullets, will be performed in the near future.

Discussion

- Therefore, we expect this suction effect to be dependent on the properties of the respective bullet, the local energy transfer to the tissue or simulant and the length of a particular missile track.

Discussion

- In summary, the findings presented in this study clearly show that the infection of a gunshot wound may be caused by bacteria resident on the skin of the exit site.

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(ที่ปรึกษา)


THANK
YOU