Conducted Electrical Weapon Drive-Stun Wounds

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The primary incapacitating effect of the modern CEW derives from the capture of peripheral motor neurons within the area between the electrodes or probes. The degree of incapacitation is directly related to the distance (spread) between these probes. During probe deployment, the spread between the probes is a function of the distance at which they are deployed toward a subject. Approximate angles of deployment are between 4° and 8° of separation. This means that the spread between the probes becomes greater as the distance increases from the deployment position to the target.

However, most CEWs can also be used by directly contacting the front of the device or the front of a device cartridge to a subject. The front of the CEW and also the CEW cartridge itself has two electrodes allowing for completion of a circuit. This method of direct contact application is often called a "drive stun" but has also been mistakenly referred to as a "dry stun", "touch stun", or "contact stun" by persons unfamiliar with standard CEW vocabulary.

On the outer surface of the CEW and also on the outer surface of a CEW cartridge, the metal contact points serve as the electrodes. In the case of the TASER M26 and X26 CEW (the most common CEWs in use today), the metal contacts are 40 mm apart on the front of the device and 45 mm apart on a diagonal on the front of the cartridge (Figs. 4.1 and 4.2). A table of electrode spacing with various is in (Table 4.1). In general, the close spacing between the electrodes yields a painful stimulus when activated but minimizes capture of peripheral motor neurons. Therefore, the drive stun method of CEW application is largely considered to be a pain compliance tool and not a true incapacitation method of control.

Because the drive stun method of application involves metal contacts being applied to the skin where tissue resistance is the highest, these types of exposures tend to produce more superficial burning when compared to the probe deployment exposures. A typical 5-second drive stun in a stationary subject yields epithelial depressions from the rectangular (2 mm × 3–4 mm) metal contacts (Fig. 4.3). These depressions are surrounded by localized blanching and a more generalized zone of surrounding redness or erythema. The blanching is likely secondary to vasoconstriction from the localized trauma of the heavy pressure that is

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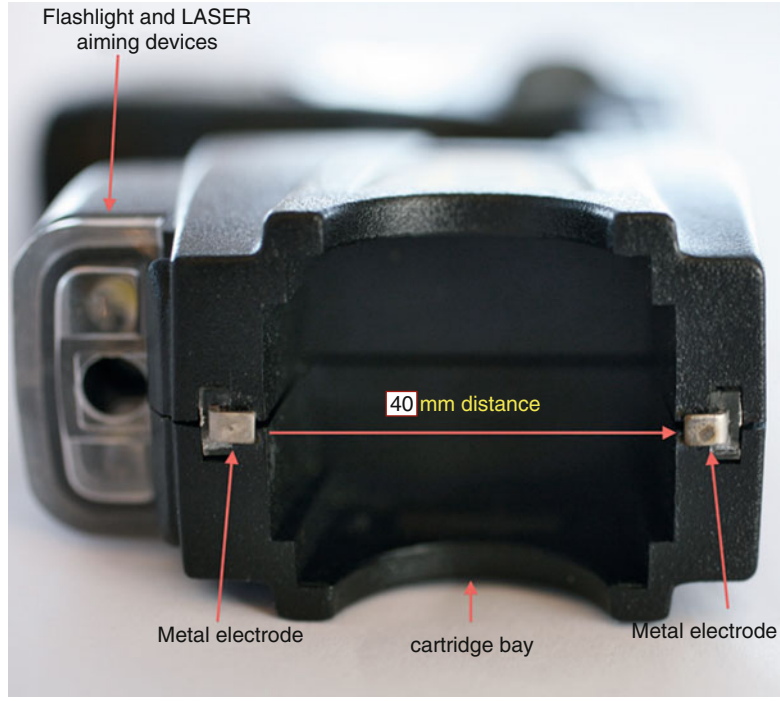

Fig. 4.1 Front end of a TASER X26 CEW (with no cartridge in place)

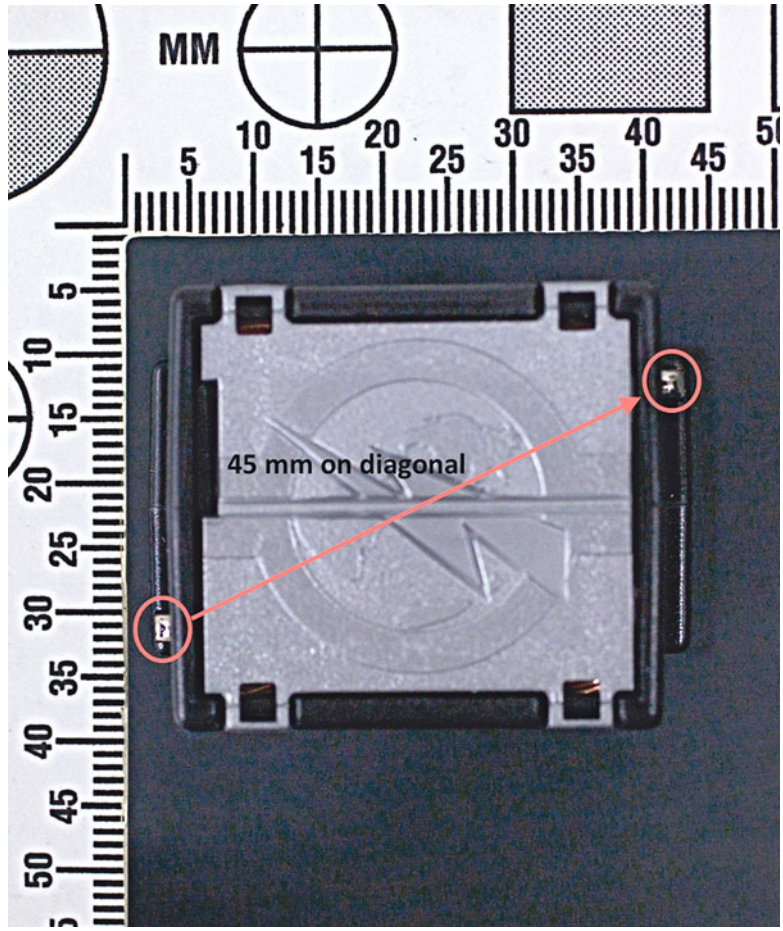

Fig. 4.2 Front end electrodes of a TASER CEW cartridge

Table 4.1 Common CEWs in use and their electrode spread measurements

	(Spent) Cartridge in place	No cartridge (mm)
TASER X26	45 mm	40
TASER M26	45 mm	40
TASER C2	35 mm	35
TASER X3	30 mm/35 mm[a]	35[b]
Stinger S200	44 mm	44

Distance between wounds if perpendicular application of device
[a]Can have a drive stun with unspent cartridges in place in this device creating 6 pairs of wounds, each wound within a pair separated by 30 mm and each pair separated by 1 cm; the separation within a pair is 35 mm with a spent cartridge in place and, with spent cartridges in place, creates 1 pair or 6 pairs depending on how activated
[b]Creates 1 pair or 6 pairs depending on how activated

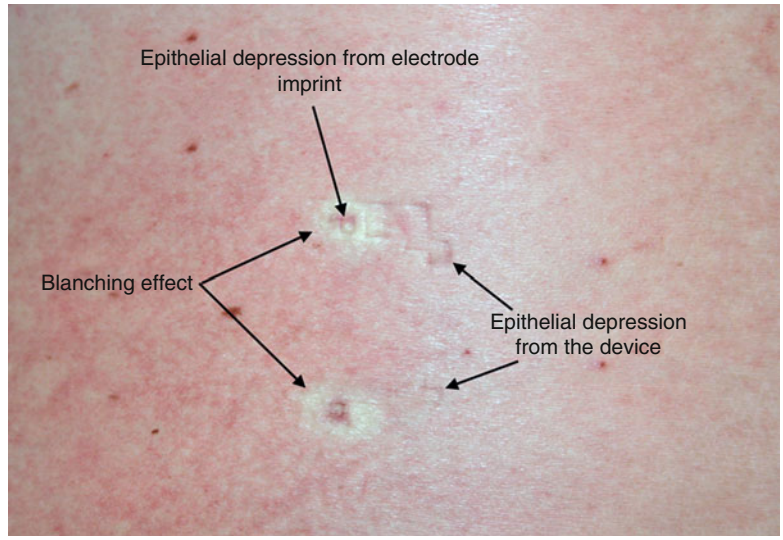

Fig. 4.3 TASER X26 CEW drive stun, no cartridge, immediately post exposure

taught to and required by the operating LEO in order to maintain good contact against a likely moving and resisting target and the localized vasoconstriction due to the electrical effect. This effect may also be seen in situations of deployed probes, and some of this localized trauma would then be secondary to the ballistic impact of the probe itself. The erythema is likely secondary to a local inflammatory response caused by the pressure as well as the transfer of heat from conducted electrical current. Histologically, the indentation seen by the naked eye on the skin surface is also a result of a localized burn effect (Fig. 4.4). Tissue injury is directly proportional to exposure time, so longer duration exposures may cause more thermal injury. Figure 4.5 demonstrates what this same area looks like at 48 h post exposure.

As stated earlier, a drive stun may also be accomplished in TASER handheld CEWs using the front of the CEW cartridge when it is in position. This is often seen after the probes located inside the cartridge have been deployed and the law enforcement officer (LEO) needs to apply additional CEW measures to gain control of a suspect. A likely scenario for this is if the deployed probes missed their target or the conductive wire from the probes that tether them to the CEW have broken. Figure 4.6 demonstrates the wound pattern seen immediately after a 5-second drive-stun CEW exposure with the cartridge in place. The diagonal relationship of the metal contacts can be appreciated in this figure. Also seen is a square pattern marking from the outline of the cartridge itself. This cartridge marking indentation is usually temporary but can

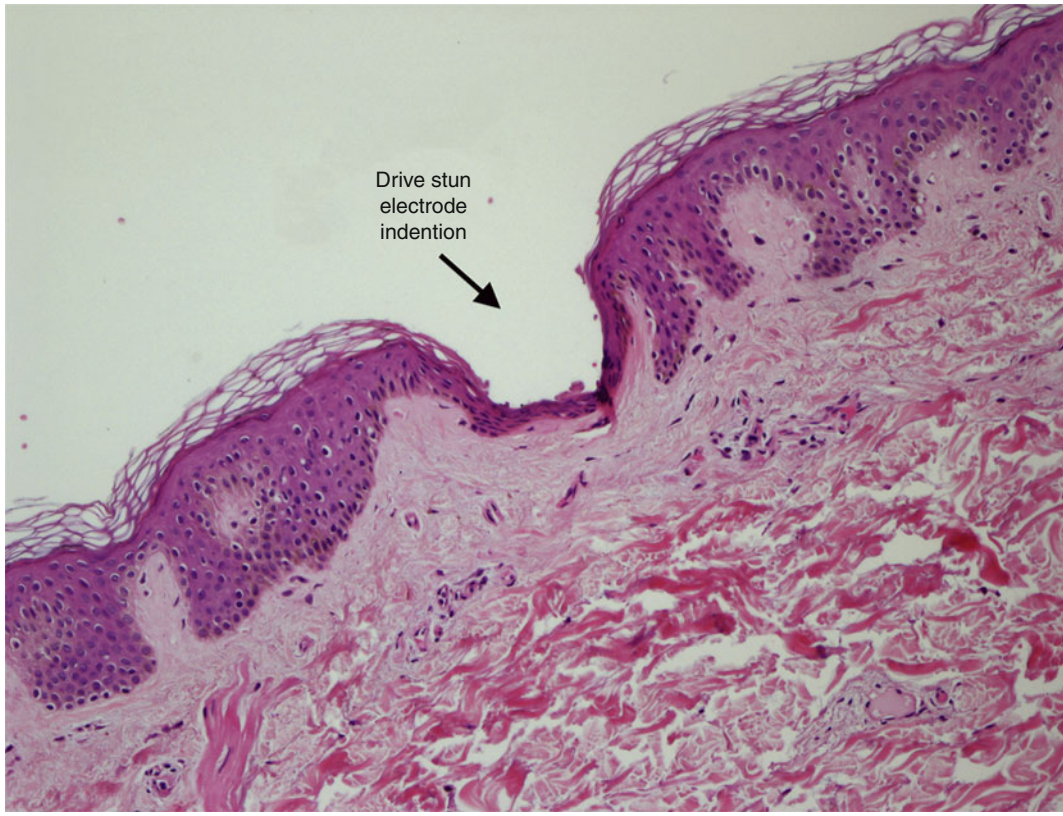

Fig. 4.4 Microscopic view of histologic section from wound in Fig. 4.3

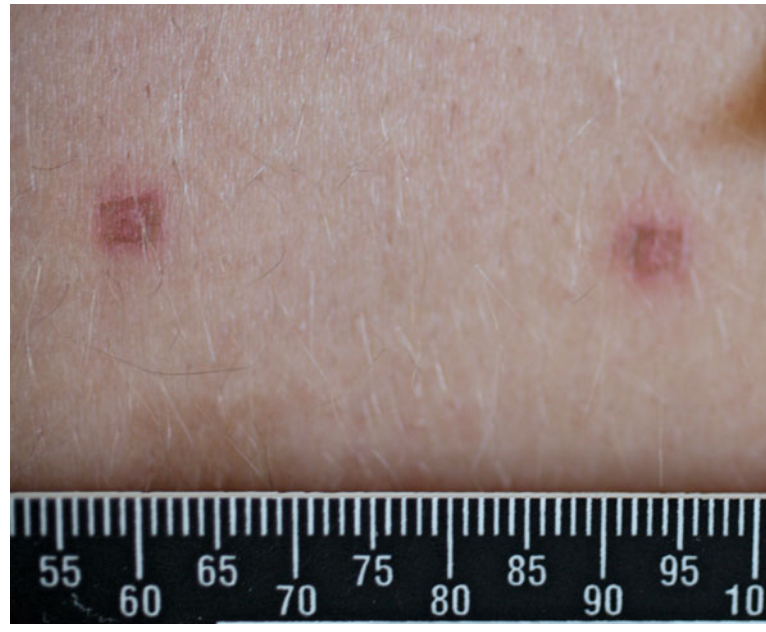

Fig. 4.5 TASER X26 CEW drive stun, no cartridge, 48 h post exposure (measurement in mm)

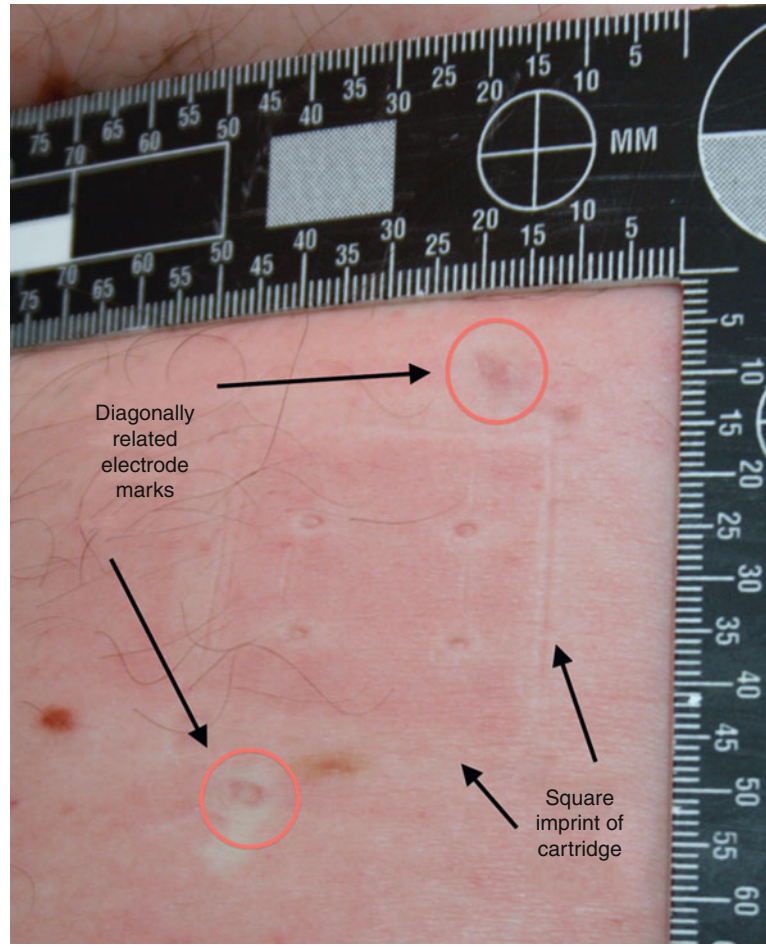

Fig. 4.6 TASER CEW cartridge drive stun with cartridge impression of area

cause abrasions that persist. It may easily be seen by personnel on the scene following a drive-stun CEW application and is something that should be noted in LEO and EMS reports. The presence of this may help alleviate future discrepancies about location and method of CEW application at a later date.

The interpretation of drive-stun wounds and patterns can be difficult and confusing, especially if being viewed and interpreted by persons with limited understanding of the CEW. When performing a drive stun, the user must physically hold the metal contacts to the skin (thus the term "drive stun" as the operator must "drive" the CEW into the recipient). This is not as easy as it may sound, especially if the recipient suspect is slippery from perspiration, moving wildly in an attempt to resist the exposure, or both. Under difficult conditions such as these, the contacts can move and may even break contact intermittently. Such movement can cause multiple wounds and patterns from a single exposure. The multiple wounds seen from a single applied drive stun are sometimes referred to as "chatter" or "skip marks" as the CEW chatters or skips across the surface of the subject. When viewed by people uninformed about this concept, it is often believed that each set of wounds is the result of an individual drive stun (e.g., a single drive stun is applied with significant skipping that yields a total of ten wounds may be interpreted as five separate drive stuns – each drive stun yields a pair of electrode wounds). This may create confusion and suspicion during retrospective investigations.

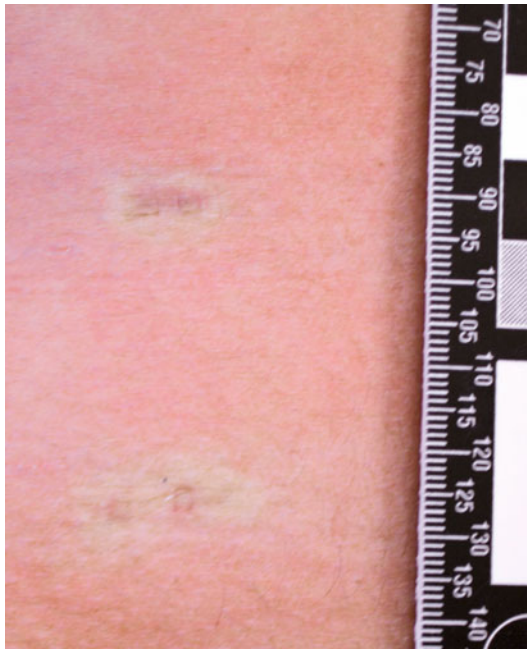

Fig. 4.7 Single TASER X26 CEW drive stun, stationary subject, moving operator, immediately post exposure (measurement in mm)

Fig. 4.8 Single TASER X26 CEW drive stun, stationary subject, moving operator, 72 h post exposure (measurement in mm)

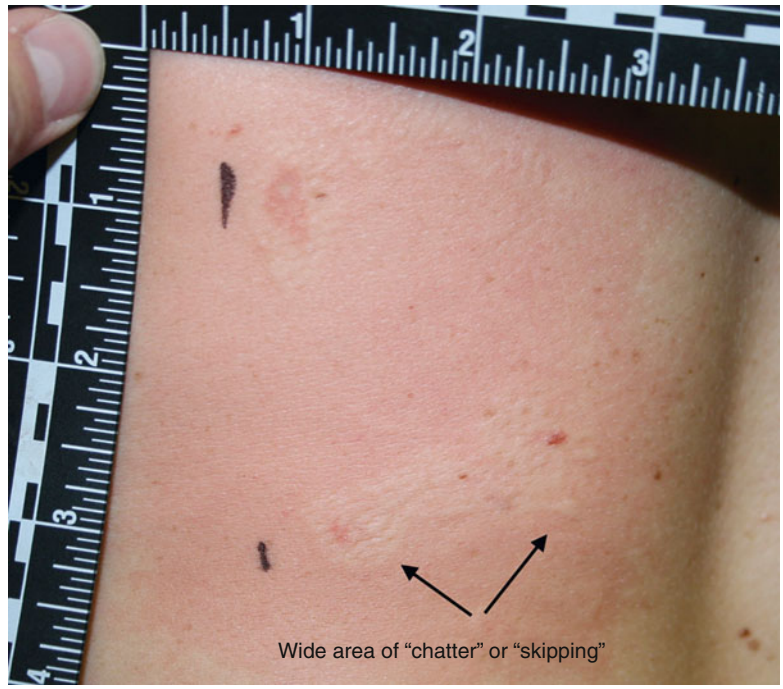

Fig. 4.9 Single TASER X26 CEW drive stun, moving subject, moving operator, immediately post exposure (measurement in inches)

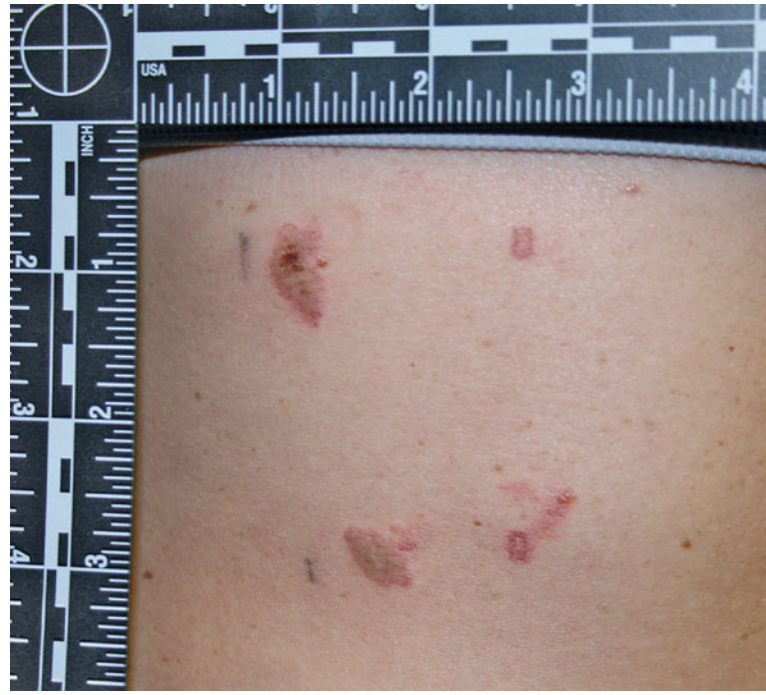

Fig. 4.10 Single TASER X26 CEW drive stun, moving subject, moving operator, 24 h post exposure

There have been numerous cases where a single drive stun has been delivered (verified by LEO report, witnesses, and CEW internal memory analysis) but a complainant maintains that they received numerous drive stuns amounting to excessive force based on the number of skip marks seen on their body.

Skip marks are shown in Figs. 4.7 and 4.8 in a relatively stationary subject (skip marks seen were caused by user movement) at different points in time. Figures 4.9 and 4.10 also show skip marks but on an actively resisting subject (both user and subject moving) at different points in time.

CEW or subject movement can also cause unique wounds or marking patterns. The blending of a single wound when the metal contact slides a small amount during the exposure creates a "smear" sign that is more ovoid than rectangular (Fig. 4.11). Movement may also lead to a "pivot" sign in which the CEW is rotated on one contact point during the exposure (one contact point remains in solid contact with the subject while the second contact point moves or pivots). Figures 4.12 and 4.13 demonstrate this pivot sign at different time periods post exposure. Significant movement of the CEW across the subject during a drive stun will most often show the "drag" sign. These are abrasions from the metal contacts as they are dragged along the body surface. This is most likely to occur on unclothed skin. Figure 4.14 is a drag sign as it appears in a 3-day-old wound.

Drag marks can be substantial in size if the user or recipient movement is significant. During violently resistive encounters, these marks may have a wide geographic distribution on the body. Figure 4.15 shows a drag sign that involves the left lower back to the right mid-back. The prominent drag sign is seen in between the two clustered wound areas. This is important to note since such wounds can lead to false claims of multiple or prolonged exposures. These wounds may also be confused with other linear markings such as fingernail- or foreign body–induced abrasions. The wounds need to be interpreted with supporting information such as the probe and wire analysis, the download analysis, and witness statements. Further detailed discussion of CEW analysis can be found in Chaps. 9 and 10.

One of the most important principles in examining and documenting drive-stun wounds is to note if the measured distance between the

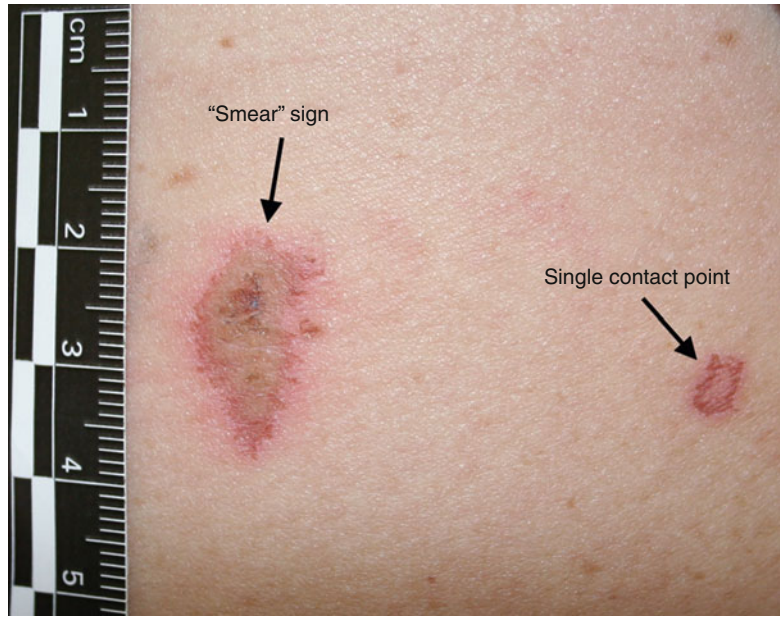

Fig. 4.11 A "smear" sign from a single drive stun at 48 h post exposure

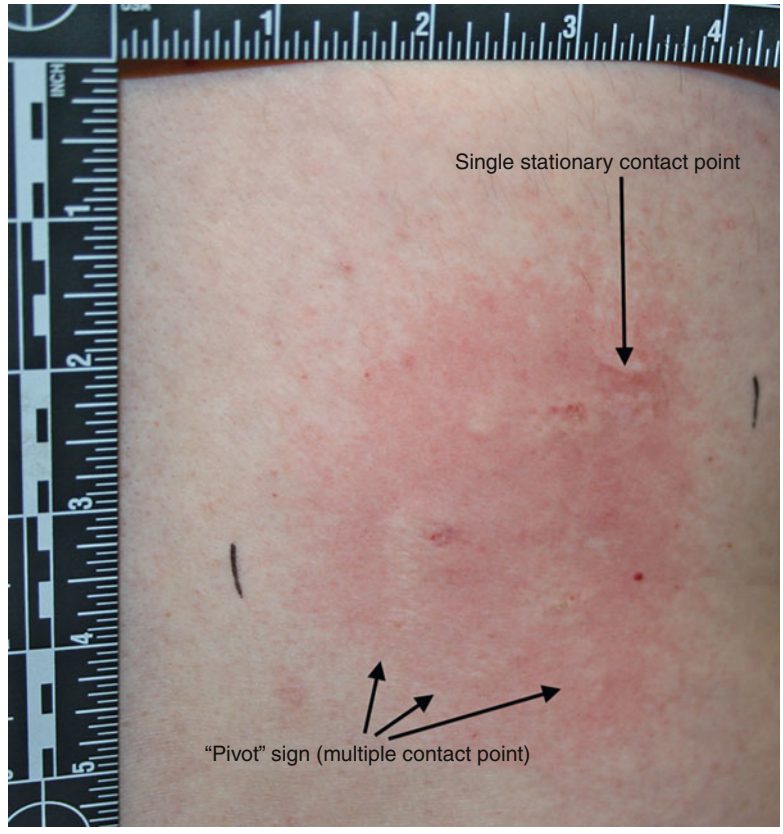

Fig. 4.12 A "pivot" sign from a single drive stun immediately post exposure

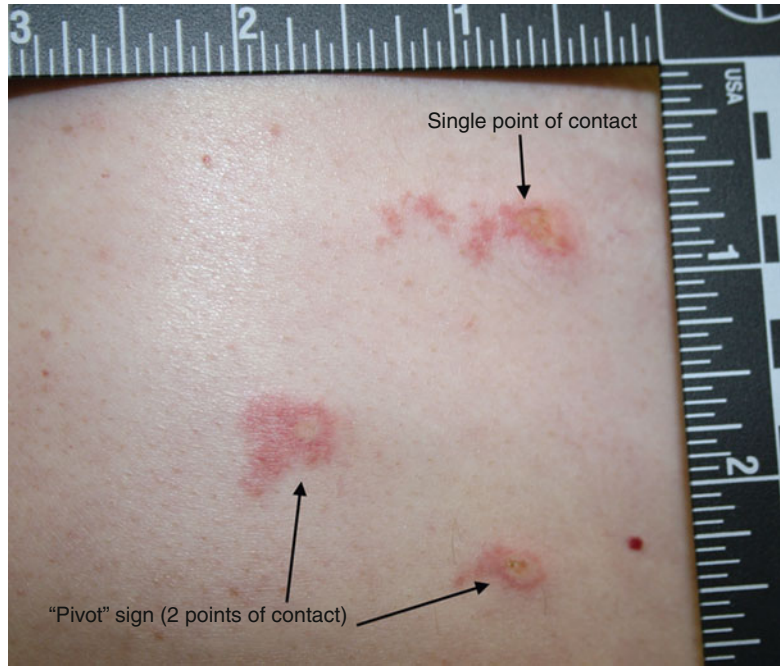

Fig. 4.13 A "pivot" sign from a single drive stun 24 h post exposure (measurement in inches)

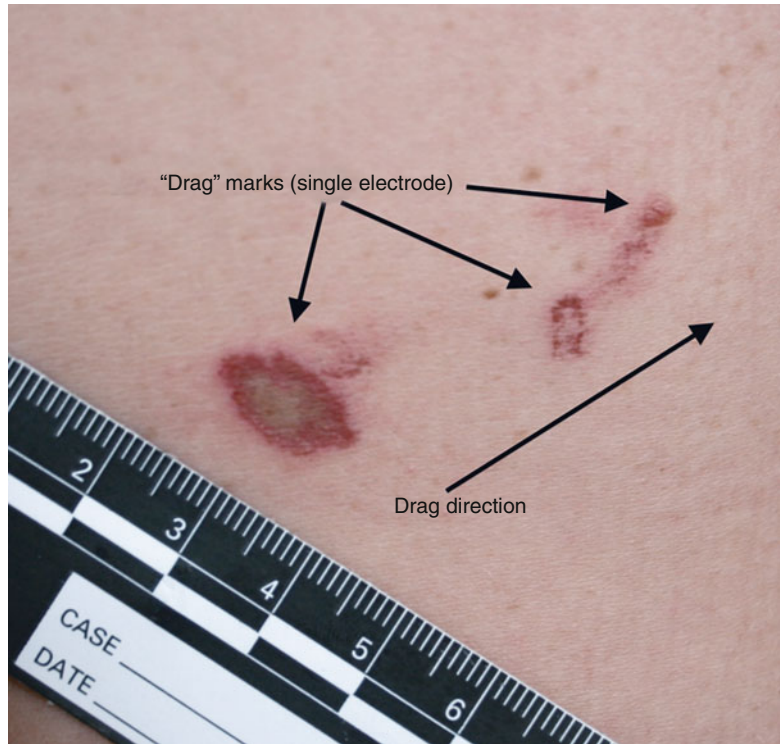

Fig. 4.14 A "drag" sign from a single drive stun 72 h post exposure (measurement in cm)

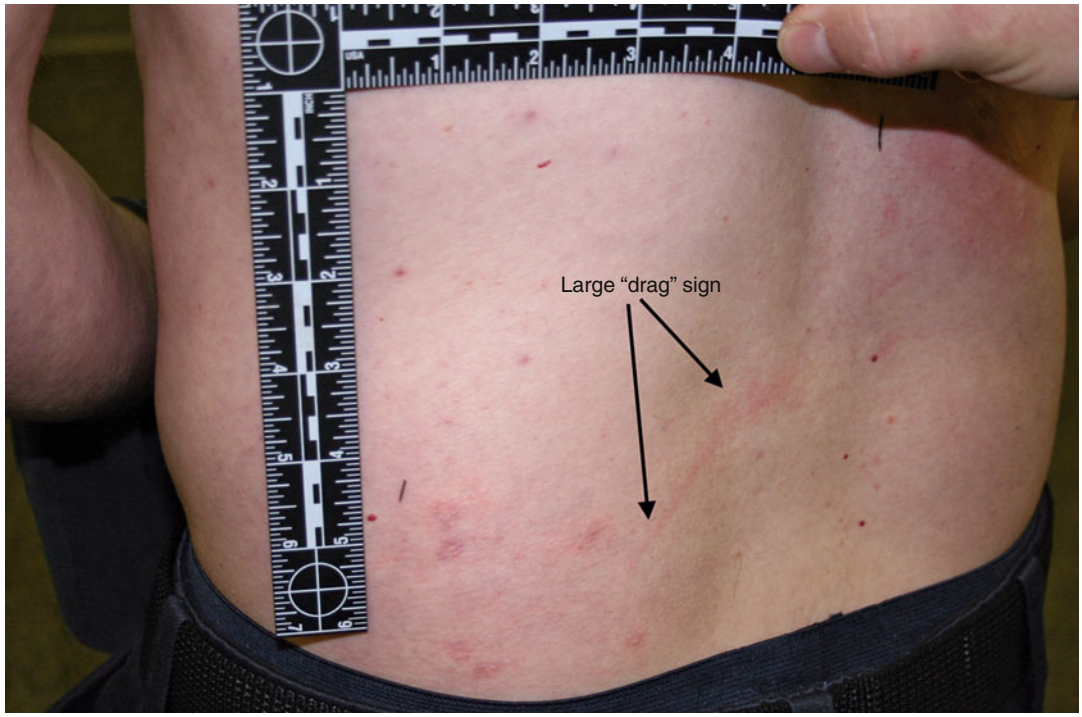

Fig. 4.15 A large “drag” sign from significant movement

Fig. 4.16 TASER X26 CEW canted during drive stun application

wounds is consistent with the measured electrode distance of the CEW in question. Using the popular TASER M26 or X26 CEWs as examples, if applied directly to the skin, the measured distance between the wounds should be 40 mm if the device was applied with no cartridge or 45 mm on a diagonal if applied with the cartridge in place. However, the wounds can be shorter distances apart if the device is canted from 0° to 45° (Fig. 4.16). When a CEW is canted, multiple marks develop immediately after the exposure from the top contact that was not in contact with the skin. This occurs because the electrical arc "strikes" variable points during application giving a diffuse wound (Fig. 4.17). These variable points, if measured, may be less than the expected 40 or 45 mm. If the canted angle exceeds 45°, the device will begin to arc to itself since the air gap distance will exceed the distance between the contacts themselves. This can leave a singular mark from the metal contact on the skin but no electrical current would be conducted to the subject.

Wound patterns will also differ depending on the CEW that is used during the drive stun application. The handheld TASER X3 CEW holds three cartridges in ready-to-use position and has six total contact points, two on each of the three cartridges (Fig. 4.18). When the cartridges are in place, a drive-stun application will involve all six contact points. This will produce a distinct and different wound pattern than the TASER M26 or X26 CEW. An X3 drive stun with cartridges in place under perfect conditions (no movement) will create six separate wounds, two per cartridge. The contacts on the X3 cartridges are 30 mm apart on a diagonal and each cartridge is 1 cm apart. If used to drive stun with spent cartridges in place or without the cartridges in place, a wound pattern 35 mm apart on a diagonal would be expected, and there may be two or six wounds depending on how the device is activated (the X3 has the functionality to allow activation of one or all three cartridge bay electrode sets). Figures 4.19, 4.20, and 4.21 depict an X3 CEW drive-stun wound

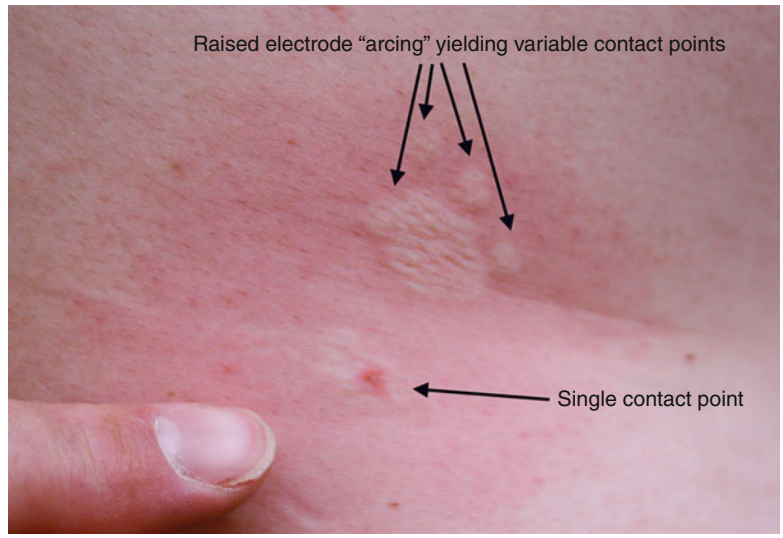

Fig. 4.17 Variable electrical arc strikes from a canted CEW application

Fig. 4.18 TASER X3 CEW cartridge front with 6 metal contact points

Fig. 4.19 TASER X3 CEW drive stun, immediately post exposure (measurement in cm)

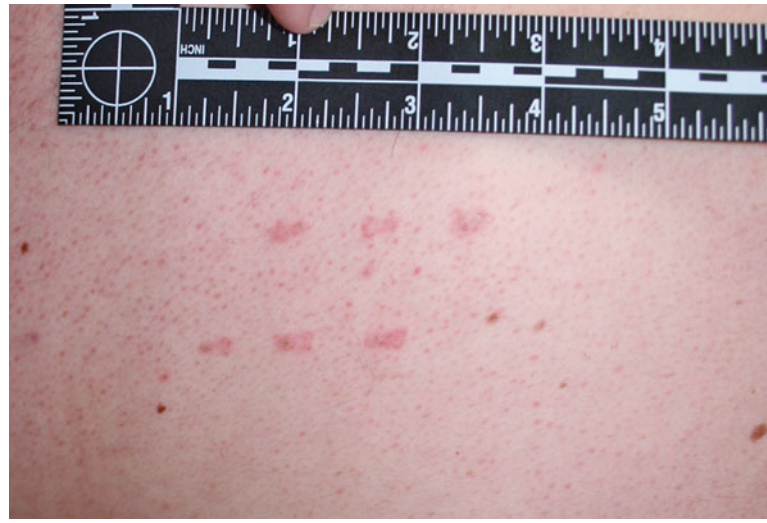

Fig. 4.20 TASER X3 CEW drive stun, 24 h post exposure

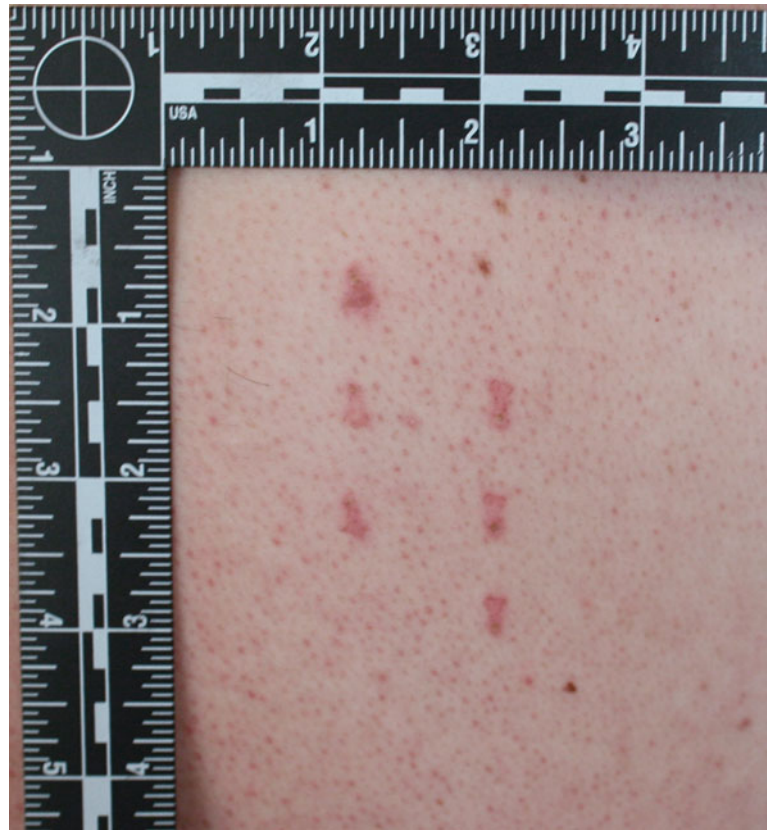

Fig. 4.21 TASER X3 CEW drive stun, 72 h post exposure

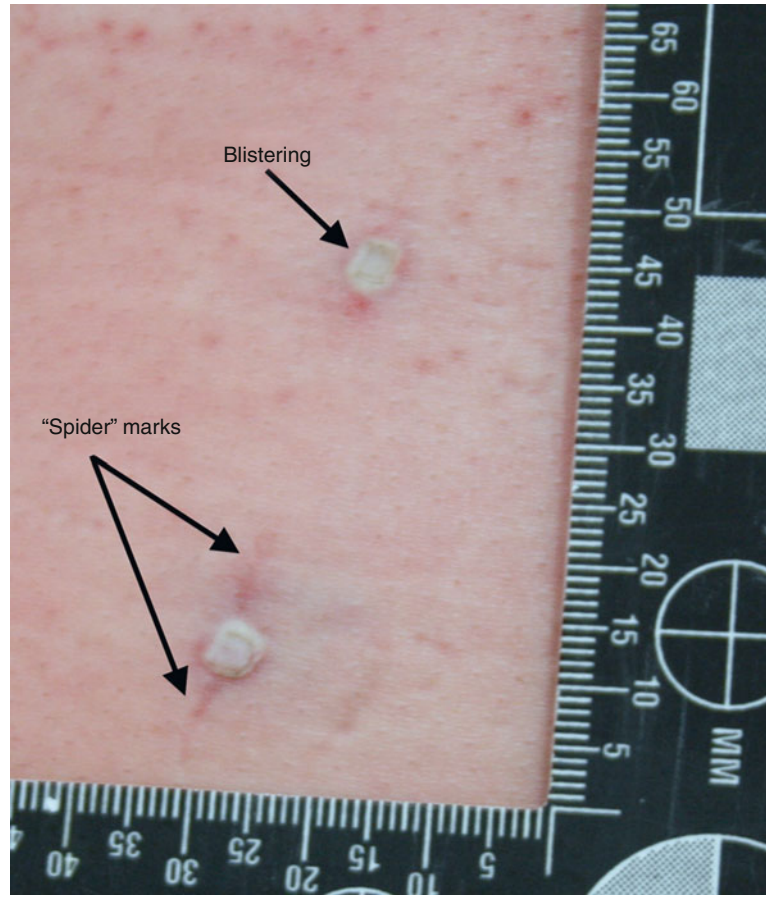

Fig. 4.22 TASER M26 CEW drive-stun wound immediately post exposure

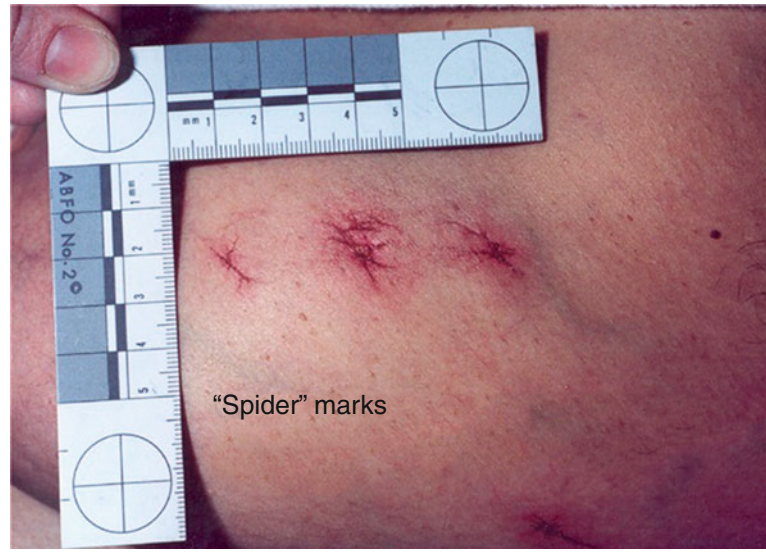

Fig. 4.23 TASER M26 CEW drive-stun wound with prominent "spider" mark effect

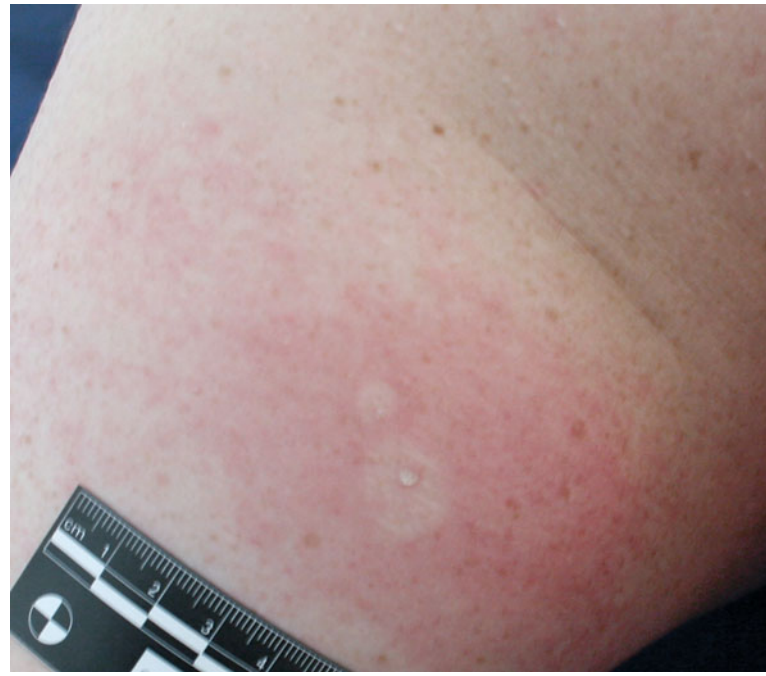

Fig. 4.24 Wound from CEW wire lying on skin immediately post exposure

with the cartridges in place as seen at various time points after exposure.

The TASER M26 CEW may also leave a distinctive wound pattern due to higher power (7 vs. 2 W of the X26) that tends to lead to more skin burning effect when compared to the X26 or X3 CEWs. Immediate blister formation is apparent from this effect. The M26 is also known to sometimes produce a distinctive "spider" mark effect adjacent to the blisters (Figs. 4.22 and 4.23). This pattern likely represents damage to small veins underneath the skin. The weakened vessel wall bulges and twists, giving this distinctive spider web appearance. These marks are also known as Lichtenberg figures. Why these are prominently seen with the M26 and not the X26 (or later generation devices) may have to do with the lower power of these devices and/or the waveform characteristics.

Similar to a drive-stun wound are the wounds created when there is arcing from a wire or an unembedded probe to the skin. This can happen if one probe makes contact and the second does not but the wire from the second is lying on the subject's skin. In this case, there would be sufficient voltage to break down the insulation and cause arcing from the wire itself. Figures 4.24 and 4.25 show the effect of this phenomenon at two different points in time. Similarly, if a probe is not in contact with the skin, but in clothing, for example, wounds can take on a more diffuse pattern. The wounds seen in Figs. 4.26 and 4.27 were created when a probe was caught in a shirt. In another example of this, a probe caught in a pair of shorts (Fig. 4.28) led to a diffuse wound pattern that can mimic a drive stun with variable markings (Fig. 4.29).

There are numerous other CEWs available in handheld format (see Chap. 1 for detailed discussion of the variety). All of them operate by direct contact and may leave wounds similar to what has been shown in this chapter. Some of these CEWs are still in production and others are not but may be still owned and used by citizens who bought them when they were available. Due to the large variation in devices and their availability, it is not possible to make generalized descriptions of the wounds from these devices. However, many of the principles

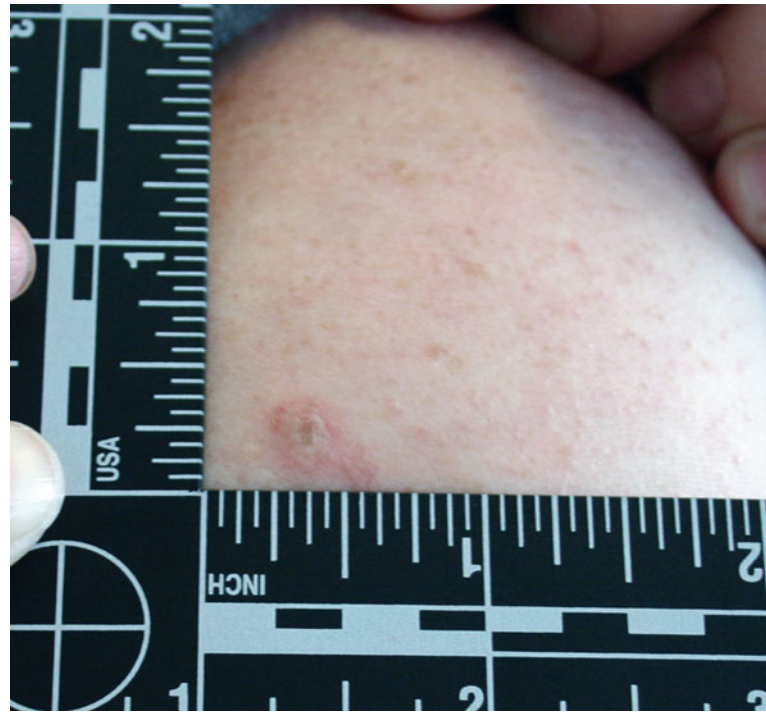

Fig. 4.25 Wound from CEW wire lying on skin 24 h post exposure

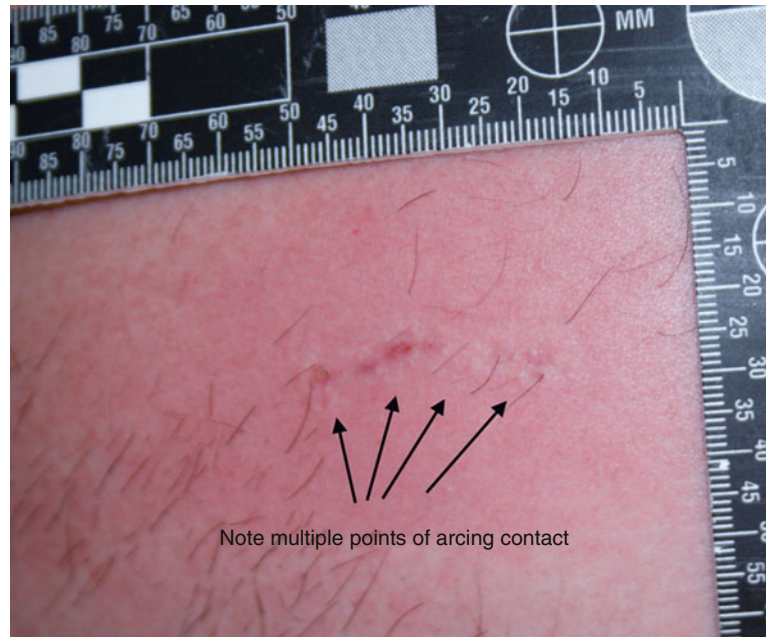

Fig. 4.26 Close-up view of wound from probe powered by TASER X26 CEW caught in shirt, did not penetrate skin creating variable points of arcing, immediately post exposure

discussed in this chapter will apply to all of these devices when investigating or examining their wound characteristics after application. Forensic matching of devices to wounds requires knowledge of the device, including measured spread between metal contacts or electrodes, shape of the electrodes, and accurate details of the application event. Having basic knowledge in this area and a diligent attention to detail will help to prevent erroneous conclusions.

Fig. 4.27 Wound from probe powered by TASER X26 CEW caught in shirt, did not penetrate skin, 15 min post exposure (measurement in cm)

Fig. 4.28 Probe caught in shorts overlying bare skin

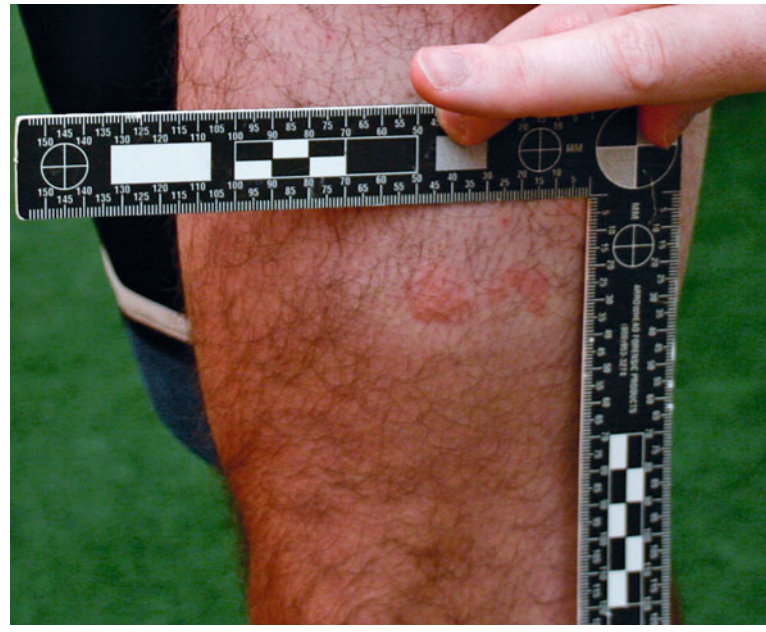

Fig. 4.29 Wound from probe powered by TASER X26 CEW caught in shorts, did not penetrate skin, 15-min post exposure