Burn injuries, avoid hem and treat them

Burns are a very common type of injury. They occur frequently to people of all age groups, social and economic classes, and geographic locations. Burns range in severity from minor to life-threatening. Minor burns are those which do not extend deep into the skin and/or are confined to small regions. Major burns are characterized by deep injury and/or by large regions.

The most common burn classification is the “degree”. Using this classification, first-degree burns only affect the outermost layer of the skin (the epidermis). These burns can be identified by a reddening of the skin as more blood flows to the area. The arteries and capillaries expand to bring allow blood to flow more easily (a process called vasodilation). The increased blood helps speed healing. First-degree burns rarely require medical attention, although they can be painful.

Scald temperature (F)	Scald temperature (C)	Exposure time required for onset of deep partial thickness burns (sec)	
		No cooling	With cooling
200	93	4.6	7.2
195	91	5.0	7.8
190	88	5.9	8.8
180	82	7.6	11
170	77	10	14
160	71	14	19
155	68	17	23
150	66	23	29
145	63	31	38

Fig. 1. Temperature and times required for deep-partial-thickness scald burns in adults.

Second-degree burns extend into the second skin layer (the dermis) where hair follicles, sweat glands, and arteries/veins reside. Because cell injury occurs to these regions, the damage is more severe than burns which are confined to the epidermis. Visually, second-degree burns are identified by blisters, redness, and swelling. These burns can be quite painful because of the irritation to the nerves within the dermis. They typically heal on their own with no medical attention, however if the burned area is large, or if post-burn infections develop, their risk increases.

Third-degree burns extend completely through both the epidermis and the dermis and into the underlying tissue. This underlying layer is composed mostly of fat and connective tissue. Since the entire dermal layer is destroyed, third-degree burns appearance may be pale because the vessels which supply blood are destroyed. If the burn appears reddened, it is because blood has left the capillaries and entered the surrounding tissue. The application of pressure to the skin leaves a pale zone which very slowly regains its redness. These severe burns are often less painful than first- or second-degree burns because the nerves in the skin are destroyed. Third –degree burns need medical attention and often require skin grafting.

Scald temperature (F)	Scald temperature (C)	Exposure time required for onset of deep partial thickness burns (sec)	
		No cooling	With cooling
200	93	2.8	4.0
195	91	3.0	4.2
190	88	3.4	4.7
180	82	4.5	6.0
170	77	6.0	7.8
160	71	9.2	11
155	68	12	15
150	66	15	18
145	63	21	26

Fig. 2. Temperature and times required for deep-partial-thickness scald burns for children whose skin is approximately 70% as thick as that of adults.

While first-, second-, and third-degree descriptions are commonly used as lay descriptions and in medical records, more detail is provided with a different characterizing system of four burn types (superficial, superficial-partial thickness, deep-partial thickness, and full thickness). Superficial burns are similar to first degree as confined to the superficial skin layer. Superficial-partial-thickness burns extend into the top part of the dermal layer. Deep-partial-thickness burns extend more than halfway through the dermis. Both superficial-partial-thickness and deep-partial-thickness burns fall under the second-degree burn classification. Full-thickness burns extend completely through the dermis and are essentially equivalent to third-degree burns.

Certain groups of people are at higher risk for severe burn injury than others. These include elderly and young children. These groups often are less able to move quickly following a burn, take longer to remove clothing or the source of heat, and they have thinner skin which burns at lower temperature. It is possible to calculate the time and temperature relationships which lead to deep-partial-thickness burns (which mark severe burns). The results are listed in Fig. 1 for adults and in Fig. 2 for children. In the tables, two sets of results are provided. The first set, labeled “no cooling” is the time required to cause deep-partial-thickness burns if the scalding liquid and any overlying clothing was not removed. The second set of results gives the time required to cause these burns if the source of heat was immediately removed after the scald duration and then the skin was cooled with room temperature water. For instance, if scalding liquid at 200F was spilled on an adult, a deep partial-thickness burn would result after an exposure of 4.6 seconds. However, if the skin was cooled quickly with room-temperature water, the scalding liquid would need a 7.2 second exposure. These results show the importance of prompt cooling to reduce injury. Readers are invited to learn more of the details underlying Fig. 1 and 2 by reading the references in original article.

Publication

Estimating the time and temperature relationship for causation of deep-partial thickness skin burns.

Abraham JP, Plourde B, Vallez L, Stark J, Diller KR.
Burns. 2015 Dec