Better Health and Environment

Burn Meter

Hospitals in the United States typically report 250,000 cases of burn injuries each year, 20,000 of which are serious enough to require hospitalization. Yet, even in this day of modern medicine with its advanced technology, the examining physician is woefully equipped to diagnose the extent of the more serious burns and prescribe the proper treatment. This situation may soon be reversed.

Today, based on research funded by the Seed Money program, a prototype machine, called an ultrasonic burn diagnostic unit, or burn meter, is under development for use in clinical trials. The significance of this development and its implications for medical treatment may be appreciated by understanding first, second, and third degree burns.

A first degree burn involves only the outer layer of skin, the epidermis, and causes blistering. Although burned and blistered, the skin remains capable of preventing infection and healing normally.

A second degree burn damages the second layer of the skin, the dermis, which contains nerves and blood vessels, and causes swelling below the epidermis. The prognosis for a second degree burn depends on the depth of the injury and whether infection occurs. Shallow second degree burns eventually heal by themselves. Deep second degree burns are more easily infected, and treatment may require removal of the burned tissue and replacement with skin grafts.

A third degree burn destroys tissues in the layer below the dermis causing blood clots, swelling, accumulation of body fluids, and a high susceptability to infection and blood poisoning. These burns almost always require removal of the dead tissue before it causes blood poisoning, and replacement with skin grafted from other parts of the body.

In serious burn cases, it is crucial, however, not to remove too much skin. If the burn area is extensive, donor skin sites may be limited and should be used sparingly. The use of skin grafting in the case of second degree burns capable of self repair should be avoided. Moreover, too much skin removal may produce unacceptable shock to the patient.

Hence, in the case of deep second degree burns, the examining physician is faced with a dilemma. Relying primarily on superficial observation, a method known to be highly imprecise and often misleading, a crucial assessment must be made of the extent of the burn and its prognosis, and whether or not radical treatment is required.

No widely used technique has been found that consistently diagnoses these cases. Several weeks may elapse before a clear demarcation emerges between second degree burns that will heal and those that will not. Delay enhances the probability of irrevocable blood poisoning and death. Early knowledge of the depth of injury would aid diagnosis and might preclude unnecessary and risky surgery.

In 1975 researchers funded by the Seed Money program laid the scientific foundation that now offers hope for a solution to this problem. Based on this research, a prototype machine, now under development for use in clinical trials, makes use of harmless sound waves, in a fashion similar to sonar, to probe the condition of the skin and its underlying tissues. Within minutes, it makes highly accurate quantitative measurements of burn depth. It also produces a clear, cross-sectional picture of the various layers of the skin, enlarged about a hundredfold, and provides the physician the essential information needed for a correct diagnosis.

Although ultrasound techniques are not new, the problems faced by the Seed Money researchers were most difficult in several areas. First, they had to work