

Lesson in Lesions

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The human integument, with its complex structural and functional organization, is one of the most remarkable packaging materials in the world. Unlike inanimate wrappers however elaborate, it has under ordinary circumstances the extraordinary facility of regenerating itself, of adapting to the local environment, and of resisting attack by all kinds of agents—chemical, physical, and biological. The reason for this situation lies in the fact that living skin, as is the case with other living tissues, undergoes continuous metabolism, with consequent growth and decay.

But in addition to its mechanical function—that of providing a tough, protective outer covering for the body—the skin has many important but little-recognized physiological properties, among these being its ability to function as a respirator in the exchange of oxygen and carbon dioxide; as a regulator of body temperature by means of sweat glands under control of the sympathetic nervous system; as an agent in the conservation of water and electrolytes; as a sensory organ to record heat, cold, pain, and touch; as a corridor for the reception of vitamins and hormones; and as a barrier against infection. Despite all these indispensable services, the integrity of the skin is so much taken for granted by almost everybody that usually no attention is directed to it until some deviation from the normal develops. Its numerous functions are poorly understood by most laymen, if not indeed by many physicians. Yet neglect of its proper care can result in serious consequences.

Proper functioning of the skin is dependent on many factors, such for example as freedom from constriction and irritation, adequate exposure to air, prompt removal of waste products from its surface, and avoidance of extremes of heat and cold. Whenever the skin is subjected to abnormal insults, the problem of skin care is multiplied many times. Since the wearing of a prosthesis, particularly on the weight-bearing lower extremity, unavoidably creates most of the conditions—constriction, excessive moisture, increased heat, mechanical irritation, and undue pressure—conducive to poor skin health, it quite naturally places upon the skin of the stump a set of demands far in excess of the normal. And not only that. Having lost one of his principal heat-

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radiating "fins," and being at the same time required to exert in locomotion more energy than does the normal person, the leg amputee commonly perspires more freely than normal, and hence his needs for skin hygiene are more acute than are those for one who walks on two natural legs.

The basic requirements of a lower-extremity prosthesis are to provide comfort, function, and appearance. Of these, comfort is unquestionably of chief importance, for without comfort the amputee will fail to obtain satisfactory function, or appearance, or both, and will ultimately either limit use of the prosthesis or else find it impossible to wear it at all. In a large percentage of cases of difficulty or failure, skin lesions of one type or another involving the stump are found to be the cause of discomfort, thus preventing the amputee from wearing the limb. Prophylaxis is, therefore, a *sine qua non* in this regard, and only through adequate knowledge of skin physiology can these disorders be anticipated and thus prevented.

Although disabling skin lesions on the stump of the leg amputee have constituted a serious complication ever since prostheses were first used for the lower extremity, full appreciation of the problem and suggestions for solution have not been forthcoming until recently. As has been typical with most problems in medicine, little was accomplished until a concerted effort was made to understand normal function and to investigate reaction to the abnormal. It is encouraging to note that there is now well under way, with the sponsorship of the Prosthetics Research Board of the National Academy of Sciences—National Research Council, a systematic attack aimed at solution of the cutaneous problems of the leg amputee.

Because even the most satisfactory lower-extremity prosthesis is of no avail if the amputee is deprived of wearing it, and because painful skin lesions in a leg stump have so frequently been the cause of inability to use an artificial leg properly, the then Prosthetic Devices Research Project at the University of California, Berkeley (now the Lower-Extremity Amputee Research Project), in conjunction with the Department of Dermatology at the University of California Medical School in San Francisco, organized in the autumn of 1954 a skin-study group to investigate the cutaneous difficulties of the lower-extremity amputee. In the course of the succeeding two years there has been accumulated a considerable body of new knowledge, not only on the nature and physiology of healthy skin but also on some of the specific clinical manifestations of skin disorders in amputees. Since the proper management of cutaneous disturbances is so essential to lower-extremity function, this issue of ARTIFICIAL LIMBS is devoted to a presentation of some of the information gathered thus far. In the first of two articles, a dermatologist discusses the anatomy and physiology of normal skin and what is to be expected when healthy skin is subjected to unfavorable conditions. In the second, another dermatologist characterizes the common skin maladies of leg amputees and offers suggestions for prevention and treatment.

An interesting observation is that proper care of the stump skin is found to be the responsibility not only of the attending physician and the prosthetist but, and even more important, of the amputee himself. Nevertheless, simple attention to good practices of daily hygiene is not enough. A considerable number of skin disorders peculiar to the lower-extremity stump present themselves despite all precautions. Some are common to all leg amputees. Many are the result of individual skin idiosyncrasies or of climatic conditions. Some are so intractable as to be amenable to cure only by total excision.

While the newer understanding has in recent years appreciably decreased the incidence of serious skin lesions in leg amputees and has made it more readily possible to deal successfully with some of those that do occur, it is obvious that much work remains to be done. For the complete etiology of many of the characteristic disease states yet remains to be elucidated. It is to be hoped that the initiative taken by the pilot study group at the University of California may prove to be a stimulus for similar investigative work at other centers of medical research throughout the world. The lesson is here for us to learn. Unless skin problems can be eliminated once and for all, there can be no true rehabilitation of the lower-extremity amputee.