

# Control of Amputation Stump Infection with an Antiseptic Skin Detergent\*

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**AUTHOR'S NOTE:** Minor skin irritations and infections are frequently encountered by the prosthodontist in the fitting and maintenance of amputation prostheses. In many instances the final fitting must be delayed until such skin infections are controlled, causing further difficulty in the proper fitting of an otherwise prepared stump. The problem is especially important in the maintenance of the prosthesis, as proper skin care can prevent many recurrent cutaneous infections and thereby eliminate unnecessary visits to the limb shop, made in the erroneous belief that the skin infection was due to an improper fit of the prosthesis. This often results in a good deal of the prosthodontist's time being consumed by a futile search for a pressure point in the socket, whereas proper skin hygiene is the correct solution of the problem.

Antiseptic skin detergents are readily available to amputees through their local pharmacy, without prescription, at nominal cost. Allergies to this product are rare, and it can be safely used by almost all amputees. It should be noted that there are actually more allergies to ordinary soaps than to this detergent.

Although I feel sure that regular and widespread use of an antiseptic skin detergent by amputees, particularly lower extremity amputees, will greatly reduce the incidence of amputation stump infection and resultant complications, it is again emphasized that such a routine is not a substitute for proper fitting and alignment of the prosthetic appliance. This still remains the primary responsibility of the prosthodontist.

The continually recurring cutaneous infections at amputation sites which are frequently encountered in prosthetic appliance clinics constitute a serious obstacle to the adjustment and rehabilitation of the amputee. By virtue of their prevalence and persistence, such infections may restrict or completely prohibit the use of otherwise satisfactory, properly fitting prostheses. This, in turn, can induce profound psychic distress which, together with the delay in resumption of an active social and economic life, can convince an amputee that his disability will never allow him to become a happy and productive member of society.

Regular hygienic care of the ampu-

tation stump as a prophylactic approach to the problem of infection appeared promising in view of the availability of an antiseptic detergent with degerming properties of demonstrated value in reducing the cutaneous bacterial population.<sup>1, 4</sup> This study, for which 74 amputees invariably applied pHisoHex<sup>‡</sup> each morning prior to adjusting their prosthetic device, was undertaken to determine whether an ensuing decrease in the incidence of infection would permit more constant and daily use of the appliance. The non-irritating and hypo-allergenic qualities of pHisoHex<sup>§, 6</sup> render the preparation particularly suitable for use over prolonged periods of time.

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*Incidence and etiology of the infectious process.* Fundamentally, staphylococci are responsible for most suppurative infections of the skin, associated with typical abscess formation. Together with streptococci and other potentially pathogenic resident microorganisms, they are ready to invade abrasions produced by devices so intrinsically frictional as prostheses. The resultant active infection may express its intensity as a small pustule or a furuncle, or may even progress to an actual cutaneous ulcer. Since elimination of local irritation is a major therapeutic measure in these conditions, the prosthetic appliance must be set aside during the healing process.

The problem of infection most frequently arises with lower extremity amputees, sequent to the continuous firm pressure of the appliance against the skin, impairment or retardation of circulation, and the deterioration of local cutaneous resistance. Inasmuch as these factors prevail even with a well-fitting prosthesis, they are greatly exaggerated by further circulatory embarrassment when the stump is choked by an improper fit. Among the lower extremity amputees more pronounced pressure phenomena may be anticipated when the limb has been removed below the knee than with the more fleshy part above the knee stump. Due to a lower relative proportion of soft tissue to bone in a below-the-knee stump, the greater pressure per square inch exerted by prosthetic devices is responsible for the greater prevalence of cutaneous irritations and infections observed in these amputees.

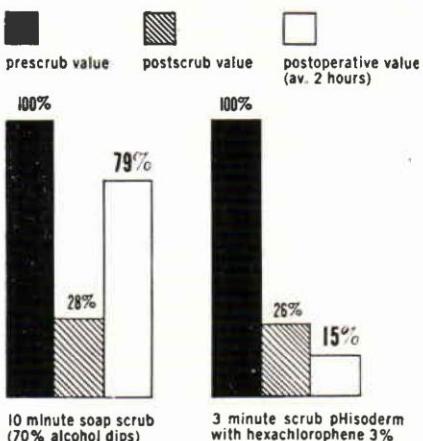
In addition to the trauma which predisposes the weight-bearing stump to dermatologic difficulties, the presence of deep, depressed, indented scars or overhanging fleshy bundles in the adductor and gluteal folds, improper weight-bearing thrust in walking when the amputee has not adequately been trained in the use of his appliance, and, particularly, poorly

fitting or outgrown prostheses have been found to increase the prevalence of infection. More recently, following widespread adoption of the suction socket for above-the-knee amputees, there has been a perceptible increase in the incidence of dermatologic disturbances in this group. The warm, moist, enclosed skin, principally with individuals prone to excessive perspiration but also with others during the summer months, provides an excellent culture medium for bacterial growth. Although the socket represents a mechanical advance, it presents the additional problem of an annoying, unpleasant odor in many cases as well as that of localized infection.

The question of maintaining healthy, intact skin is not, however, confined to weight-bearing stumps but is also of concern with upper-extremity stumps. In effect, wherever a prosthesis is used regularly in a working function the integrity of the cutaneous surface must be preserved to achieve maximum benefit from the artificial limb. It was our intent to do this through the daily cleansing and degerming of the skin in direct contact with the appliance.

*Selection of a prophylactic agent.* The prolonged antiseptic and non-irritating properties of pHisoHex, which have served to establish the antiseptic detergent as a routine pre-operative preparation for the surgeon's hands and for the operative field, appeared well suited to the prophylaxis of cutaneous infections. Many clinical studies reported in the literature have demonstrated the efficacy of pHisoHex in reducing the bacterial population of the skin as well as the long duration of the resultant antisepsis.<sup>5, 10</sup> The prolonged antisepsis is further evidenced by the usual sign posted over the surgeon's scrub sink in most hospitals advising him that the scrub period can be shortened provided he is a constant and daily user of pHisoHex. The bacteriostatic and bactericidal action

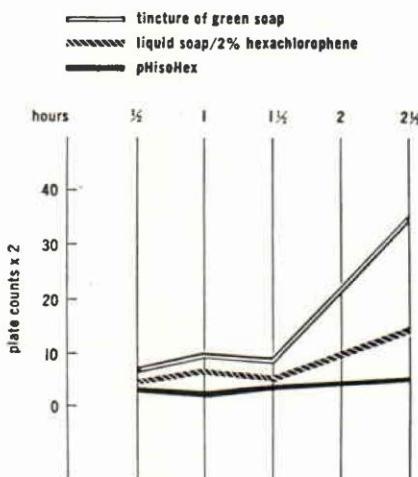
of the preparation exceeds that of ordinary soap-hexachlorophene combinations, and it more successfully maintains the reduction in bacterial flora. Figure 1 presents a comparison of the antibacterial effects of a 3-minute pHisoHex scrub with those of a 10-minute soap scrub.<sup>11</sup>



**Fig. 1. Comparison of antibacterial effects of a 3-minute pHisoHex scrub with those of a ten-minute soap scrub.**

The number of bacteria obtained on culture of the hands prior to scrubbing with either agent is represented by 100 per cent.

Confirmatory evidence that a 3-minute pHisoHex scrub was equal in antibacterial effect to a 10-minute scrub with green soap, alcohol, ether and tincture of Zephiran Chloride was obtained by another group of investigators in a series of several hundred subjects.<sup>10</sup> As part of the same study they were also able to demonstrate a reduction in resident bacteria on skin surrounding raw and denuded surfaces cleansed with pHisoHex.



**Fig. 2. Comparison of antibacterial activity of commonly used preoperative scrubbing agents.**

A further comparison of the antibacterial activity of pHisoHex and 2 other commonly used preoperative scrubbing agents is presented in figure 2. Total bacterial counts of the hands were carried out at half-hour intervals following scrubbing with tincture of green soap, liquid soap containing hexachlorophene, and pHisoHex with the results shown.<sup>12</sup>

Prior to our study pHisoHex had successfully been applied as a prophylactic measure against cutaneous infection in another particularly susceptible group, the diabetics.<sup>3, 13</sup> Ritualized scrubbing of the feet and legs with the antiseptic detergent was found an effective control procedure and, when included as part of a routine method of treatment in one series, reduced the incidence of pyogenic infection by 90 per cent per patient per year.<sup>3</sup> This is of particular significance to the diabetic to whom acute infection frequently presents an actual threat to life.

A final property of pHisoHex which recommended it to us was its ability to abolish undesirable odors for as long as 18 hours in washed areas.<sup>14</sup> This was considered valuable in view of the fact that objectionable odors have been associated with the wearing of prostheses during the summer months and throughout the year in those individuals who perspire freely.

**Procedure.** Seventy-four amputees originally participated in our study. Of these, however, 12 failed to report regularly for observation and have not been included in our evaluation. The remaining 62 individuals comprised 25 above-the-knee amputees, 23 below-the-knee amputees, 9 suction-socket cases, 2 below-the-elbow amputees, 2 amputations referable to circulatory difficulties, and 1 hip disarticulation. Thirty-four had previously experienced cutaneous disorders, 10 exhibited severely scarred stumps, and 3 were bothered by unpleasant socket odor.

Each amputee received a plastic squeeze bottle containing pHisoHex for direct application of the antiseptic detergent. He was instructed to use only a few drops of pHisoHex, to add as much water as necessary to produce a thin lather, and to massage this lather well into the stump. The need for particular care in covering as thoroughly as possible depressed scars, crevices, and other areas likely to support bacterial growth was emphasized. The stump was then wiped dry without removing any remaining detergent so that a thin film of the material was left on the washed area to exert a persistent antibacterial action. This procedure was carried out each morning or just prior to adjustment of the prosthesis for the day. During the warm months the application of pHisoHex twice daily, in the morning and at night, was recommended to those individuals prone to excessive perspiration or with a history of recurrent skin infection. After

several months of treatment or during the winter months a reduction in frequency to 3 times weekly was considered. Some amputees reported the accumulation of a sticky, scum-like secretion as a result of perspiration during the night, and they were advised to thoroughly remove this material by means of the pHisoHex wash prior to use of their appliance.

Results of treatment were evaluated in all cases 8 to 12 months after initiation of the regimen, while 11 amputees were followed for as long as 16 to 21 months.

**Results.** The results of our study are summarized in table 1. Improvement of the integrity of the cutaneous surface of amputation sites, expressed as a reduction in the incidence of infection, and adjudged by the more constant and daily use of prosthetic appliances, was manifested by all amputees in this series. Of the 33 individuals who adhered to a rigid pHisoHex schedule, 31, or 93.9 per cent, exhibited an excellent response to the hygienic regimen and 2 showed improvement over their pre-treatment state. Of the 29 individuals who applied pHisoHex irregularly, 21, or 72.4 per cent, were adjudged excellent, while the remaining 8 were considered improved. No allergic reactions were observed in any of our test group.

Some of the participating amputees reported their observations during the test period. One individual with severe chronic dermatitis of both legs was well controlled and manifested improvement on following a regular pHisoHex schedule. One case of recurrent furunculosis of the stump of long duration cleared with the regular use of pHisoHex, but the furunculosis recurred once more when the regimen was discontinued. One amputee who perspired excessively throughout the year and presented a socket odor problem was well controlled with the regular application of the antiseptic detergent. One instance of cutaneous difficulty, cleared

up by treatment, recurred within a week of cessation of the pHisoHex wash. One amputee who had no difficulty when using the detergent regularly, developed recurring furuncles on his extremely hairy stump 4 months after he had stopped using the recommended hygiene.

Of 3 individuals who might be considered less responsive to the pHisoHex treatment 2 persisted in using poorly fitting prostheses and the other had a sebaceous cyst which required surgical excision.

TABLE 1

*Efficacy of pHisoHex in Controlling Amputation Stump Infection*

Number of participating patients.....	74
Number failing to report regularly.....	12
Active participants.....	62
<b>Classification of amputees</b>	
Above the knee.....	25
Below the knee.....	23
Suction socket.....	9
Hip disarticulation.....	1
Below the elbow.....	2
Circulatory difficulties (Buerger's disease) .....	2
Number of amputees with severe scars	10
Number of amputees with previous cutaneous disorders.....	34
Number of amputees with socket odor problems .....	8
<b>Duration of pHisoHex regimen</b>	
First evaluation, 62 patients .....	8 to 12 mos.
Second evaluation, 11 patients .....	16 to 21 mos.
<b>Results</b>	
Number of patients using pHisoHex regularly.....	33
Excellent response.....	31
General improved.....	2
Number of patients using pHisoHex irregularly.....	29
Excellent response.....	21
Generally improved.....	8

#### CONCLUSIONS

1. pHisoHex is recommended for regular use in the hygienic care of amputation stumps. It is particularly valuable in maintaining cutaneous integrity and reducing the incidence of infection in below-the-knee amputations, stumps marred by severe or depressed scars, and stumps in contact with suction sockets.

2. A regular pHisoHex regimen will successfully control odor problems in individuals who perspire excessively throughout the year and in all amputees during the summer months.

3. pHisoHex should be applied daily for optimal results. A few drops should be worked into a lather with water and massaged into the stump. The stump should then be dried without rinsing so that a thin film remains on the surface to exert continued antibacterial activity.

4. As a direct result of the reduction in cutaneous infection effected by pHisoHex more regular and continued use of prosthetic appliances is possible.

5. When good stump hygiene is maintained the serviceability of prostheses is increased and the frequency of replacement is reduced.

6. The use of an antiseptic skin detergent is not a substitute for proper fitting and alignment of a prosthetic appliance. It will not correct skin conditions resulting from unbalanced pressure.

#### SUMMARY

A frequent difficulty incident to the continued use of a prosthetic appliance, regardless of maintenance or fit, is the recurrent cutaneous infection. Since this prevents the daily use of the prosthesis and delays complete rehabilitation, this study was undertaken to evaluate benefits to be derived from regular hygienic care of the amputation stump with an antiseptic skin detergent. pHisoHex was selected as the prophylactic agent on

the basis of the many published reports of its marked degerming properties and hypo-allergenicity.

Experience with 74 amputees, 62 of whom were observed over an 8- to 12-month period, has demonstrated the value of a regular pHisoHex wash schedule in reducing the occurrence of infection and in maintaining the integrity of the cutaneous surface. Referrals to both the dermatologic and surgical outpatient clinics has decreased remarkably since the institution of this pHisoHex routine. Surgical drainage of stump abscesses and furuncles is rare, effecting a considerable economy in amputee and hospital staff time. Many amputees, particularly those with below-the-knee stumps and those wearing suction sockets, are now able to use their appliances regularly and with greater comfort than ever before. The pHisoHex regimen also successfully controlled the odor problem during the summer months and throughout the year for those individuals who perspire excessively. The effective control of sweat and skin secretions considerably lengthens the serviceability of the prosthetic appliance by inhibiting deterioration of those parts which come in direct contact with the skin; this is especially true for suction sockets.

The cost of maintaining good stump hygiene, an important contributor to amputee morale and rehabilitation to an active social and economic life, is remarkably low. The investment in an 8-ounce bottle of pHisoHex, which lasts an average of four months, and the time required for the daily wash procedure afford the amputee an inestimable return in comfort and facility in the use of his prosthesis.

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