

## **Bacteria on stumps of amputees and the effect of antiseptics**

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### **Abstract**

Amputees get stump infections usually from the natural inhabitants of the healthy skin and probably due to the unnatural environment of tight fitting sockets. The aim of the present study was to investigate the natural stump bacteria and the effect of antiseptics as well as the amputees' evaluation of such treatment. Fifteen amputees using their prostheses all day were investigated. Bacterial samplings were taken by swab technique with respect to bacteria and fungi from the stumps in the morning before prosthetic application and in the evening after a whole day's prosthetic use without antiseptic cleaning; after antiseptic cleaning with a combination of Isopropanol 45%, N-propanol 30% and N-cetyl-pyridiniumchloride 0.2% for one day; after fourteen days continuous use. The patients were asked if they liked the antiseptic and if they would like to continue to use it. Two patients did not submit bacteriological samples after the cleaning period. Before cleaning *S. epidermidis*, *S. aureus* and alpha-hemolytic streptococci were commonly found. In two instances gram negative rods were found. After the cleaning period there was a reduction of bacteria in 11 out of 13 patients. All patients liked the antiseptic and the simplicity by which the stumps and the sockets could be kept clean. The authors feel that the use of antiseptics to increase stump and socket hygiene is justified.

### **Introduction**

It is a well known clinical observation that recurrent superficial infections are common in stumps of amputees (Barnes, 1956; Levy, 1956;

1983). Bacterial samplings from the infections usually show *Staphylococcus aureus*, *Staphylococcus epidermidis*, diptheroids, and alpha-hemolytic streptococci, known to be natural inhabitants of the healthy skin (Davis et al, 1980; Levy, 1983). It is well known that occlusion and raised temperature of the skin leads to changed bacterial flora both with respect to amount and type of species (Aly et al, 1978; Hartman, 1983; Marples & Klingman, 1969). The unnatural environment for the stump skin of a tight-fitting occlusive plastic socket with increased temperature and moisture compared to the normal in combination with high repeated loads makes the stumps extra vulnerable to infection (Barnes, 1956; Levy, 1956). If the amount of bacteria can be kept low by, for instance, antiseptics there are reasons to assume that the risk of stump infection will decrease.

The aim of the present investigation was to study stump bacteria and the effect of antiseptics as well as the amputees' evaluation of the treatment.

### **Materials and methods**

Fifteen persons of which 5 were below-knee, 4 above-knee and 6 arm amputees using their prostheses all day were investigated. The amputees were studied in three different series. In the first no antiseptics were used and the amputees cleaned their stumps and sockets as usual. In the second series the stumps and the sockets were cleaned with antiseptics i.e. Isopropanol 45%, N-propanol 30% and N-cetyl-pyridiniumchloride 0.2% on a one-time-use cloth, twice during one day. In the third series antiseptic cleaning was used twice a day for fourteen days. In the two latter series the amputees cleaned their stumps and prosthetic

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sockets in the morning before prosthetic application and after a whole day's use. Samplings were made by swab technique with respect to bacteria and fungi from the stumps before prosthetic application and antiseptic cleaning in the morning and in the evening after a whole day's use before socket and stump cleaning.

Specimen swabs were processed by the laboratory within 24 hours after the collection. Bacteria were isolated and identified using the routine techniques of the Department of Microbiology at Karolinska Hospital laboratory (Lenette et al, 1980).

The patients were asked if they liked the antiseptic and if they would like to continue to use it.

### Results

Two patients did not submit to bacteriological samplings after the cleaning period. One of these, who had a previous history of eczema, got skin irritation from the treatment. The other used the antiseptic and gave no reason for not sampling but could be evaluated for his subjective feeling of stump hygiene. Before the cleaning period *S. epidermidis*, *S. aureus* and alpha-hemolytic streptococci were commonly found. In two instances gram negative rods were found, one in an above-knee and one in a below-knee amputee. In the cases of above-knee amputees group B, C and D streptococci were commonly found. There were no obvious

changes of bacteria during the day when no antiseptics were used. After the cleaning periods there was reduction of *S. aureus* and streptococci. Bacterial reduction was observed in 11 out of 13 amputees. No difference in reduction was observed between the short term and the long term use of antiseptics. In spite of inconstant apparent reduction of bacteria all the patients experienced subjectively improved hygiene and wanted to continue to use the antiseptic. The results are summarized in Table 1. In one patient the leather covering of the socket partly lost its flexibility due to cleaning with the antiseptic.

### Discussion

The present investigation showed a reduction of the natural bacteria of the stump skin with respect to species when cleansed with antiseptics. The amount of bacteria are probably always decreased in spite of the fact that the investigation failed to demonstrate any constant decrease. All the patients liked the antiseptic and the simplicity by which the stumps and the sockets could be cleaned.

The sole of the foot is the only part of the body developed for high repeated loads. The stump skin of an amputee is therefore subjected to unnaturally high loads. In a tight plastic socket the skin gets warm and wet by perspiration decreasing the physical strength and increasing the amount of bacteria (Allende et al, 1961; Aly et al, 1978; Hartman, 1983;

Table 1. Bacteriological finding before and after the use of antiseptics

No.	Age	Sex	Type of amputee	Bacteriological finding		Subjective feeling
				before	after	
1.	22	F	arm	A; C;	A;	improved
2.	35	F	arm	A;	A;	improved
3.	45	F	arm	A; B;	A; G;	improved
4.	46	M	arm	A; B;	skin irritation	
5.	67	M	arm	A; C;	A;	improved
6.	67	M	arm	A; B;	A; B;	improved
7.	17	M	BK	A; B; C;	A; C;	improved
8.	33	M	BK	A; B;	A;	improved
9.	39	M	BK	A; B; G;	A; B;	improved
10.	42	M	BK	A; D;	A;	improved
11.	49	M	BK	A; B;	A;	improved
12.	24	M	AK	A; B;	—	improved
13.	47	M	AK	A; D; E; G;	A; E; G;	improved
14.	48	M	AK	A; C; D;	A; D;	improved
15.	53	F	AK	A; F;	A;	improved

### Abbreviations

A = *S. epidermidis*

C = alpha-hemolytic streptococci

E = Group-C-streptococci

G = Gram-neg rods.

B = *S. aureus*

D = Group-B-streptococci

F = Group-D-streptococci



Levy, 1983; Marples & Klingman, 1969). It is therefore not surprising that the stump skin gets easily torn and is vulnerable to infections. Since the skin of the stump is so vulnerable it must be of utmost importance to keep it clean. It is often difficult for the amputees to maintain high standards of hygiene in their sockets since the skin is covered by tight fitting plastic material. If the hygiene is bad the situation gets even worse with dominant odour, recurrent infections and sometimes ruined stumps (Jackman, 1982). The theory of the present investigation was that cleaning stumps with a well known and long lasting combination of antiseptics might increase stump hygiene by reduction of bacteria (Barnes, 1956; Davis et al, 1980). All patients studied reported an increased feeling of stump hygiene probably due to reduction of both bacterial spectrum and amount. The reason for the failure to demonstrate a constant effect on the bacteria could be that there really was a very limited effect. Another more plausible reason is that the methods used were simple clinical routine bacterial sampling directed to demonstrate the presence of bacteria and not the amount of bacteria present. Whether long time use of antiseptics can decrease the rate of stump infections remains to be investigated.

The type of bacteria observed in the study corresponds well with reports from other authors (Allende et al, 1961; Roth & James, 1989). The combination Isopropanol, N-propanol and N-cetyl-pyridiniumchloride is widely used for preoperative hand washing and is known to inhibit growth of bacteria, fungi and some viruses (Korting et al, 1987). To avoid drying out effects on the skin a somewhat oily skin protecting agent was added to the solution. The wet one-use cloths were chosen since it was felt that it would be the most convenient way for the amputees to administer the agent.

Sockets made of leather should be cleaned carefully with antiseptics containing isopropanol. There are reasons to assume that the physical properties of this leather may be changed by the disinfectant. This of course does not imply that the stumps cannot be cleaned with the agent. Patients with a history of eczema should be warned that the mixture may cause skin irritation.

Because of the positive reports from the

amputees and the effect on skin bacteria we feel that the use of antiseptic agents to increase stump and socket hygiene is justified.

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