

# Hand Hygiene – Different Approaches

Dr. Manfred Rotter

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## Hand Hygiene – different approaches

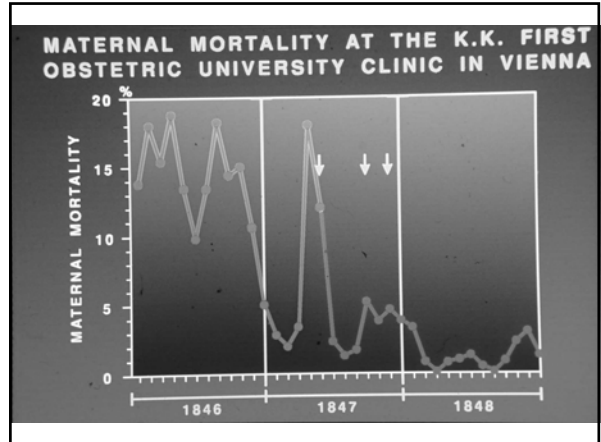
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## Microbial flora of hands

- Resident Flora
- Transient Flora
- Infectious Flora

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## Resident Flora of Hands

- Staphylococcus epidermidis
- Coagulase negative staphylococci
- Staphylococcus aureus (carriers!)
- Micrococci
- Diphtheroids
  
- Acinetobacter spp.
- Klebsiella spp. (seldom)
- Enterobacter spp. (seldom)

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## Features of Transient Flora

- Does not multiply in or on skin, rather dies off
- Easily mechanically removable for instance by washing hands
- Pathogenic importance depends on the species, the virulence as well as local or systemic resistance of the host

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## Features of Resident Flora

- Multiplies in and on the upper strata of skin
- Difficult to remove mechanically (only 50% every 5 min by soap and water)
- Stronger reduction possible only chemically by antiseptics (and antibiotics)
- Protective function (colonization resistance)
- Pathogenic importance usually low except in tissues in sterile body cavities, especially together with foreign bodies

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### Microbial Flora of infected skin lesions

Flora with pathogenic importance

- **Staphylococcus aureus**  
(Panaritium digiti, Paronychia, Boils etc.)
- **Streptococcus pyogenes**  
(Phlegmonous lesions)

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### Examples for the efficacy of handwash procedures (all 1 min)

Agent	Conc. %	Mean log <sub>10</sub> Reduction
Povidone-Iodine det.	7,5 w/v	3,8*
Chlorhexidine gluc. det.	4,0 w/v	3,1
Triclosan liquid soap	0,1 w/w	2,9
2-Biphenylol liquid soap	2,0 w/w	2,6
Octenidin-di HCl liquid soap	0,5 w/w	2,5
Sapo kalinus	20,5 w/v	2,7

\* significantly (p<0,05) greater than sapo kalinus

### Strategies for the prevention of microbial transfer via hands (1)

To reduce the release of transient flora

*Hands are still clean*

*Keep hands clean*  
No-touch technique  
Gloves (protective)

*Hands are contaminated*

No „dangerous“ contamination  
Patient secretions, excretions, blood, infected sites  
Finishing microbiology work

*Render hands clean*

Hand wash or Hygienic handrub  
Hygienic handrub  
Hygienic handrub

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### Examples for the efficacy of handrub procedures (all 1 min)

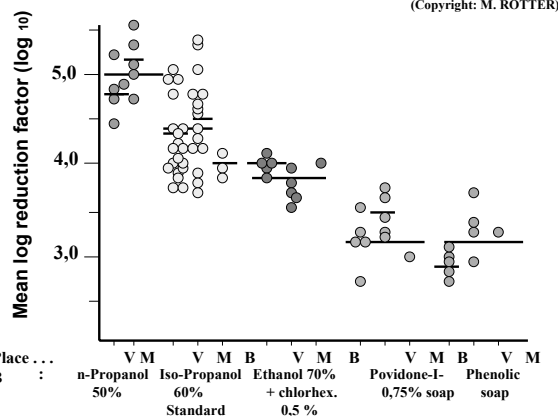
Handrub	Conc. %	log Reduction
N-propanol	100 v/v	5,8
	60 v/v	5,5
	50 v/v	4,9
	40 v/v	4,3
Iso-Propanol	70 v/v	4,9
	60 v/v	4,2 - 4,4
	50 v/v	3,9
Ethanol	80 v/v	4,5
	70 v/v	4,0 - 4,3
	60 v/v	3,8
Povidone-Iodine solution	1 w/v	4,0

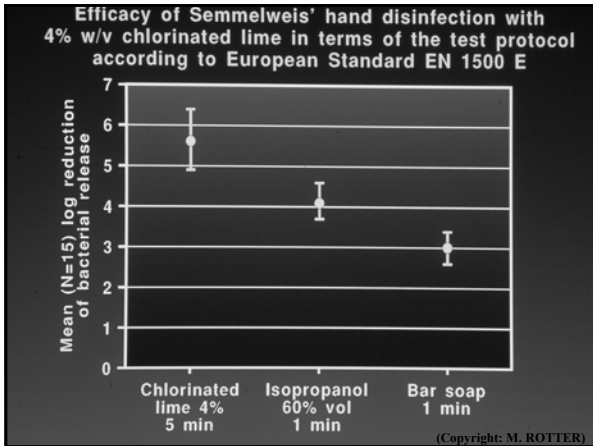
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### Reduction of release of testbacteria from artificially contaminated hands by washing with soap and water

Duration	Mean log <sub>10</sub> reduction
15 s	0,6 – 1,1
30 s	1,8 2,3-2,5 2,5-2,8
1 min	2,7 3,0
2 min	3,3
4 min	3,7

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**Antibacterial efficacy of gels for hygienic handrub according to EN 1500 (artificially contaminated hands) (3)**

No	Declared active chemical	Conc. %/v/v	Application Vol. ml	Time s	Mean lg Reduction Product Reference	Pass/Fail
1*	Ethanol	90	1x3	1x30	3.8 ns 4.0	P
2*	Ethanol	90	1x3	1x30	4.3 ns 4.6	P
3*	Ethanol	90	1x3	1x30	3.9 ns 4.1	P
4*	Ethanol	90	1x3	1x30	4.7 4.5	P

Reference: Propan-2-ol 60% v/v (rinse), 2x3 ml/2x30s; \* significant at p ≤ 0.1, one-sided; n.s.: not significant

\* Kampf et al 2002 Rotter/CHCA/Deustf 03

**Antibacterial efficacy of gels for hygienic handrub according to EN 1500 (artificially contaminated hands) (1)**

No	Declared active chemical	Conc. %/v/v	Application Vol. ml	Time s	Mean lg Reduction Product Reference	Pass/Fail
5	Ethanol	60	2x3	2x30	3.5 * 4.1	F
6a	Ethanol	60	1x1	till dry	3.6 * 4.5	F
6b	Ethanol	60	2x1	2x30	4.0 * 5.1	F
7a	Ethanol	90	1x3	1x30	3.8 * 4.4	F
7b	Ethanol	90	2x3	2x30	4.2 ns	P

Reference: Propan-2-ol 60% v/v (rinse), 2x3 ml/2x30s; \* significant at p ≤ 0.1, one-sided; n.s.: not significant

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**Effect of condition of hands dry or wet on the efficacy of hygienic handdisinfection with iso-propanol 60 % v/v**

Condition of hands before disinfection	mean lg reduction
Dry	4,3 ± 0,6 *
Wet	3,7 ± 0,6

\* p<0,05  
Disinfection time 1 min, Test bacterium E. coli ATCC 11229, Sampling method finger-tip method, design of study cross-over, 15 volunteers

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**Antibacterial efficacy of gels for hygienic handrub according to EN 1500 (artificially contaminated hands) (2)**

No	Declared active chemical	Conc. %/v/v	Application Vol. ml	Time s	Mean lg reduction Product Reference	Pass/Fail
1	Propan-2-ol	60	1x2	till dry	2.9 * 4.2	F
2	Propan-2-ol plus Triclosan	45 ?	2x3	2x30	3.9 * 4.5	F
3	Propan-2-ol plus Phenoxyethanol	60 0.1	3x2	3x20	4.2 n.s 4.2	P
4a	Propan-2-ol plus	70	1x3	1x30	3.8 * 4.4	F
4b	Butandiol	0.1	2x3	2x30	4.5	P

Reference: Propan-2-ol 60% v/v (rinse), 2x3 ml/2x30s; \* significant at p ≤ 0.1, one-sided; n.s.: not significant

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**Flash points of several concentrations of ethanol and the propanols as assessed according EN 22719**

Concentration (%V/V)	Flash point (°C)		
	Ethanol	Isopropanol (Propan-2-ol)	N-Propanol (Propan-1-ol)
100	12	12	15
95	13,5	13,5	16,5
90	15	15	19
82			21
80	17,5	18	21,5
70	20,5	21	25
68	21		
60	23,5	24,5	28

Shadowed area: „Easily flammable“ (Storage restrictions)  
Other area: „Flammable“

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## Strategies for the prevention of microbial transfer via hands (2)

To reduce/prevent the release of transient AND resident flora

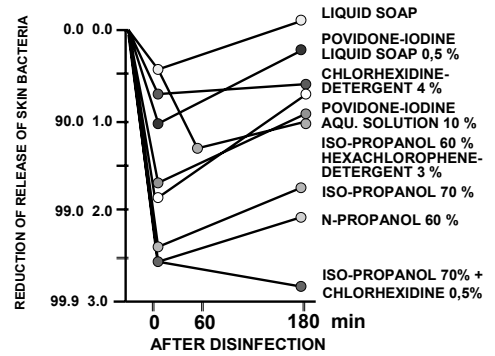
*Prevent microbial release*

Before surgical activity  
In protective isolation  
Hand colonisation

Surgical scrub and gloves  
Hygienic handwash, gloves  
Treat diseased skin:  
antiseptic handwash  
local chemotherapy (?)

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## EFFICACY OF SURGICAL HAND DISINFECTION (5 min)



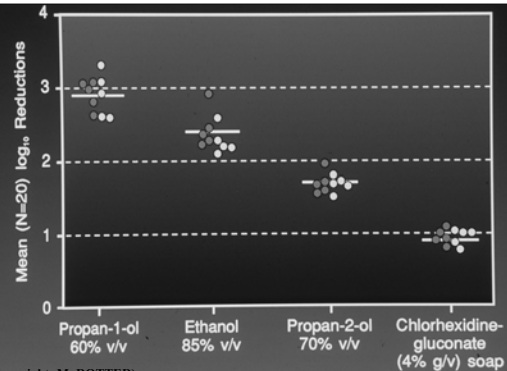
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## PERFORATION OF SURGICAL GLOVES-FREQUENCY (J. Holborn 1981)

Type of Surgery	Proportion (%) gloves perforated		Number gloves
	left	right	
Orthopaedic	46,9	28,6	98
Soft tissue	21,7	10,9	92

## Surgical hand disinfection according to EN 12791

Intralaboratorium, five experiments in Latin square design, left and right hands



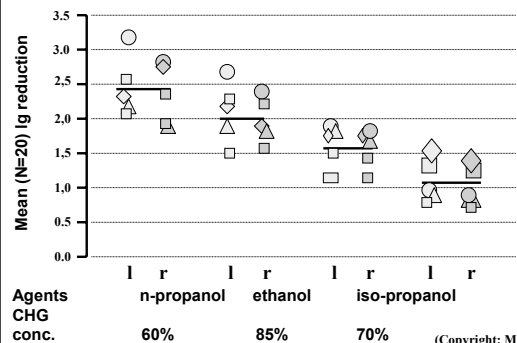
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## SURGICAL GLOVE LESION AND WOUND INFECTION FOLLOWING CLEAN SURGERY (calculated from Cruse & Foord 1973)

Glove lesion	Patients Infection / all n / N	Infection ratio %
YES	29 / 548	5,3 *
NO	300 / 17.542	1,7

\* 2 p< 0,0001

## Surgical hand disinfection - mean Ig reduction of skin flora achieved with 4 disinfectants in 5 laboratories on both hands



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## Surgical hand disinfection Effect (immediate) of application time

Alcohol	Conc (%) v/v	Mean (N=20) log RF <sub>immed</sub> (Standard deviation)			Trend p
		Application time (min)			
		1	3	5	
n-propanol	60	1.1	2.0	2.3	<0.001
		0.1	0.2	0.3	
iso-propanol	70	0.7	1.5	2.1	<0.001
		0.1	0.2	0.3	

## Strategies for the prevention of microbial transfer via hands (3)

Infected skin lesions

Refrain from activities  
such as

- Surgery
- Handling foodstuff
- Pharmaceuticals

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## Antibacterial immediate effect of gels for surgical handrub according to prEN 12791 (normal skin flora)

No	Declared active chemical	Conc. %/v/v	Application		Mean lg Reduction		Pass / Fail
			Vol. ml	Time min	Product	Reference	
1	Ethanol	90	nx3	3	2.4	ns 2.8	P
2a**	Ethanol	90	nx3	3	2.5	ns 2.1	P
2b**	Ethanol	90	nx3	3	2.1	ns 2.2	P

Reference: Propan-1-ol 60% v/v (rinse), nx3 ml/3 min; n.s.: not significant; (p > 0.1, one-sided)

\*\* Kampf et al 2003

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## TECHNIQUE OF SURGICAL HAND DISINFECTION

- Short (30 – 60s) social handwash and cleaning of subungual spaces with nailsticks
- Use clean brush for nails only, don't brush skin
- Dry hands with clean towel
- Rub an alcoholic preparation onto the hands up to the elbows taking as much and often as is necessary to keep hands wet for 3 min
- Air-dry hands before donning gloves

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