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CORNET: Hygienic Safety in Connection with the Use of Tattoo and Permanent Make-up dyes

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1. Aim of the Research Project

Pan-European Aim

Health risks by tattoos and permanent make-up can be caused by different factors: e.g. by toxic tattoo dyes, by chemical contamination of tattoo dyes, by hygienic contamination / impurities of dyes or by a non-sufficient hygiene status in the tattoo studios.

In this research project the hygiene status of tattoo studios in Austria, Germany, and Belgium was analysed. Possible microbiological contaminations are characterized.

In order to clarify the current situation of dyes hygiene, the microbiological state as well as durability of dyes are assessed under praxis and laboratory conditions. The tattoo dyes are examined by means of modern chemical analysis in accordance with their inorganic (e.g. heavy metals) and organic composition (e.g. pesticide contamination, aromatic amines etc.). A toxicological profile of the tattoo dyes is prepared. Therefore, standard techniques and / or new procedures are developed and optimized, in order to determine the mentioned test criteria. Moreover, existing tattoos and / or areas of excised tattoos are controlled dermatologically, and the results are documented.

Based on these results, a recommendation for a guideline is written, which facilitates the practical work in tattoo studios. It also contains a list of the chemical and toxicological characterizations of the examined dyes, in order to reduce the health risk of tattoo dyes and permanent make-up.

German Part

For the German research project, data of the toxicological examination are documented. Furthermore, microbiological controls of different tattoo dyes and tattoo and permanent make-up studios are performed. Additionally, a dermatological examination of the dyes is carried out.

2. Approach

Total Project

The research project is divided into three working areas:

- Assessment of the actual hygiene status in tattoo studios and of the used tattoo dyes of all participating countries as well as a microbiological analysis of the used dyes.
- Analysis of the tattoo dyes (chemical condition and toxicological profile)
- Preparation of a general recommendation for tattooing

German Part

The German contribution is the toxicological characterization of selected tattoo dyes by means of in vitro tests as well as microbiological and dermatological assessments of tattoo dyes, tattoo studios or tattoo, respectively.

The tattoo dyes are toxicologically examined regarding their cytotoxicity, phototoxicity, cutaneous metabolism, skin compatibility and skin penetration as well as possible allergenic characteristics by means of in vitro procedures. Furthermore, microbiological assessments of 50 tattoo studios as well as experiments regarding possible microbiological contamination / impurity of tattoo dyes, tattoo equipment and tattoo studios were performed. For the dermatological assessment of tattoos the clinical experiences with tattoos, the release of allergies against tattoo dyes and the pathological procedures after tattoo excision were from large interest.

3. Results of the German Part

Eight out of 21 examined tattoo dyes showed an irritating potential; among them are four of the five-examined red shades. Seven tattoo dyes had phototoxic properties (these are only orange or red shades), see table 1.

Nearly all of the tattoo dyes tested by three-dimensional skin models showed skin incompatibilities after longer exposure time. None of the tested tattoo dyes induces the release of IL-1β and TNFα in the skin. However, the IL-6 expression increased with application time for nearly all tested dyes. This suggests a sensitizing (contact allergenic) potential of the tested dyes.

Although the real dye pigment did not diffuse through the skin, the penetration results showed clearly that admixtures or impurities of the tattoo dye diffuse through the skin and may be metabolized. This suggestion was clarified by metabolism experiment, which showed that by adding tattoo dyes to keratinocytes, potentially toxic and allergenic compositions and impurities migrated into cells and were metabolized.

50 tattoo and permanent make-up studies were microbiologically examined on ten positions. The hygiene-status were analyzed by means of a questionnaire. All studios were tested after previous announcement. The execution and evaluation of microbiological samples as well as the differentiation of the detected microorganisms were carried out and assessed in agreement with the Austrian partner.

Tab. 1: Cytotoxicity and photocytotoxicity results of tattoo dyes.

Manu-facturer	Dye	Cytotocitiy	Phototoxicity
A	Red 1	non irritating	No
	Green 1	non irritating	No
	Blue 1	non irritating	No
B	Black 1	non irritating	No
C	Black 2	slightly irritating potential	No
	Black 3	slightly irritating potential	No
D	Black 4	non irritating	No
E	Orange 1	non irritating	Possible
	Red 2	**irritating potential**	Possible
	Blue 2	non irritating	No
F	Red 3	**irritating**	Possible
	Blue 3	non irritating	No
	Black 5	non irritating	No
	Orange 2	non irritating	Possible
G	Orange 3	non irritating	**Yes**
	Red 4	**irritating potential**	**Yes**
	Blue 4	**irritating potential**	No
H	Red 5	slightly irritating potential	No
	Blue 5	non irritating	No
	Orange 4	slightly irritating potential	Possible
I	Black 6	non irritating	No

The summary of the microbiological sampled showed a high microbiologic contamination at the palm of the tattooists, on the treatment chair and on the working clothes of the tattooists as given in Figure 1.

Moreover, 25 different tattoo dyes were tested with respect to their possible microbiologic contamination. Except the dyes black 3, blue 5, and black 6, all samples were microbiologically inconspicuously.

The preservative challenge test did not show sufficient preservation against *Staphylococcus aureus* of the two examined dyes.

The dermatological assessments of existing tattoos showed that the predominant part of patients with tattoos did not have any compatibility problems with tattoos. If compatibility problems arose than mainly due to sensitization against red dye. Red dye is the most difficult dye to remove by laser technique. Nearly all dyes caused acute irritations directly after application, but only after application of red and orange dyes irritations occurred which might indicate a sensitization or an allergic inflammation.

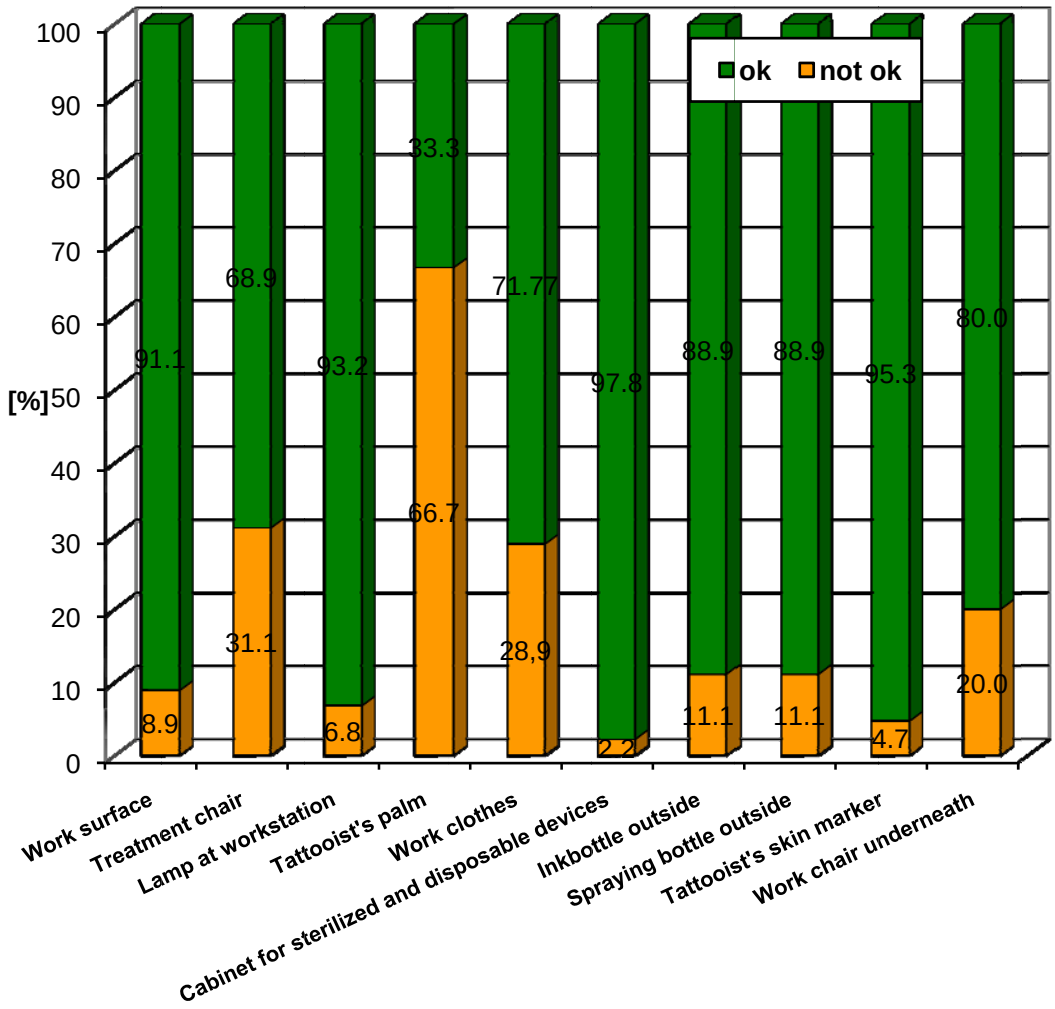

Figure 1: Results of contact slide tests at different places in tattoo studios.

4. Annotation

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The final report of the German part of this Pan-European project is send on request. Please ask for it at the office of the FKI.