

방부제에 의해 유발되는 자극감에 대한 화장품에서의 영향 요인 연구

이 은 영[†] · 최 동 원 · 안 수 선 · 문 성 준 · 장 이 섭 · 은 희 철*

태평양기술연구원 피부과학연구소, *서울대학교 의과대학 피부과
(2006년 2월 2일 접수, 2006년 2월 11일 채택)

A Study of Influencing Factors for Sensory Irritation Due to Preservatives of Cosmetics

Eunyoung Lee[†], Dongwon Choi, Susun An, Seongjoon Moon, Ihseop Chang, and Hee Chul Eun*

AmorePacific Corporation R&D Center, 314-1, Bora-ri, Giheung-eup, Yongin-si, Gyeonggi-do 446-729, Korea

*Department of Dermatology, Seoul National University College of Medicine

(Received February 2, 2006; Accepted February 11, 2006)

요약: 화장품에서 홍반과 같은 피부 자극뿐만 아니라, 육안적으로 관찰되지는 않으나 소비자에게 불쾌감을 주는 따가움, 화끈거림, 가려움 등의 자극감을 평가하는 것도 중요하다. 스스로 민감성이라고 생각하는 사람들이 증가하는 추세에 자극감에 대한 연구는 더욱 중요해 지리라 여겨진다. 현재까지 자극감을 유발한다고 알려져 있는 알러지 있는 유발 화장품 원료는 lactic acid, glycolic acid, ethanol, 방부제류, 향료류, menthol 등이 있으며 pH가 증가할수록, 폐쇄 조건 등으로 흡수가 증가할수록 자극감이 증가한다고 알려져 있다. 본 연구에서는 화장품에서 많이 사용하고 있는 방부제 4종(methylparaben, propylparaben, phenoxyethanol, chlorophenecine)의 자극감에 영향을 주는 요인들을 찾아보고자 하였다. 연구 결과 팩 제형과 같은 흡수가 증가되는 제형에서와 그렇지 않은 제형에서의 방부제에 따른 자극감 결과에 차이를 보였다. 또한 서로 다른 방부제가 혼합된 경우에 상승 효과에 의하여 자극감이 높아지는 결과를 보인 경우도 있다. 무엇보다 phenoxyethanol과 chlorophenecine은 매우 미약한 자극감을 유발하였으나 혼합 사용한 경우에는 자극감이 상승되는 결과를 나타내었다. 이와 같은 결과로 보아 방부제에 의한 자극감은 제형에 의한 흡수 정도나 혼합되는 원료의 특성에 따라 자극감의 정도가 차이가 있는 것으로 보인다. 새로운 화장품의 원료의 선택시 이러한 영향을 함께 고려하여야 할 것으로 여겨진다

Abstract: Sensory irritation is one of the important side effects of cosmetics and it is required to develop new products that are more tolerable to the consumers. There are lots of cosmetic ingredients known to induce sensory irritation such as lactic acid, glycolic acid, ethanol, preservatives, fragrances and menthol etc. It is also known that sensory irritation increases by change of pH as well as additional occlusive conditions. The aim of this study is to know various factors affecting sensory irritation due to preservatives (methylparaben, propylparaben, phenoxyethanol and chlorophenecine). We also wanted to investigate the effect of preservatives to sensory irritation according to change of formulations. Our results showed that sensory irritation increased with the conditions of increasing absorption such as packs. We have also found that sensory irritation increased synergistically when to apply two different preservatives together. For example, phenoxyethanol and chlorophenecine themselves have weak sensory irritation potentials, but we observed phenoxyethanol combined with chlorophenecine synergistically increase of sensory irritation potentials. In conclusion, formulation and combination of different preservatives should be considered to reduce the unwanted sensory irritation of preservatives.

Keywords: sensory irritation, methyl paraben, propyl paraben, phenoxyethanol, chlorophenecine

1. Introduction

Sensory skin irritation represents the array of bothersome symptoms such as stinging, burning and itch-

ing that can occur even without visual signs of skin inflammation [1] and is sometimes called subjective irritation to differentiate it from objective signs, erythema and scaling [2]. This can often lead to consumer dissatisfaction, and it has been regarded as one of the important side effects of cosmetics. Therefore it is re-

† 주 저자 (e-mail: eylee@amorepacific.com)

quired to develop new products lessing sensory irritation which are more tolerable to consumers. There are lots of cosmetic ingredients known to induce sensory irritation such as lactic acid, glycolic acid, ethanol, preservatives, fragrances and menthol [3,4], however, the mechanism of sensory irritation is poorly understood.

It is well established that some individuals are more likely to experience sensory irritation than the rest of population. Frosch & Kligman described a method for detecting these sensitive individuals, classifying them as 'stinger' or 'non-stingers' [5,6]. Thus toxicologists can conduct the evaluation of sensory irritation potential in the susceptible individuals of pre-selected group.

p-Hydroxybenzoic acid esters (parabens) have been widely used as preservatives for cosmetic products, and it has been known those parabens often induced stinging on human facial skin [7]. However, there has been few studies about the effect of preservative on sensory irritation according to different concentration. In addition, there have been also scarcely reports of preservative's effect on subjective irritation in relative to combined use of them or change of formulation.

The aim of this study is to know various factors affecting sensory irritation due to preservatives. We also wanted to investigate the effect of preservatives to sensory irritation according to combined use and change of formulations.

2. Materials and Methods

2.1. Volunteers

Sixteen healthy subjects (6 females, 10 males) were included in this study. The mean age was 28.3 years (25 ~ 36 years). All subjects were free of systemic or skin diseases and had not used any topical preparations on the test areas during the study period. Informed consent was obtained from all the subjects.

2.2. Sensory Irritation Test

After cleansing the face with water and drying with tissue gently the subjects rested for 10 min in a environment controlled room (temperature $24 \pm 4^\circ\text{C}$, relative humidity 40 ~ 45%). Test materials were applied on each side of nasolabial fold and cheek at random. Panelists' stinging and burning reactions were recorded

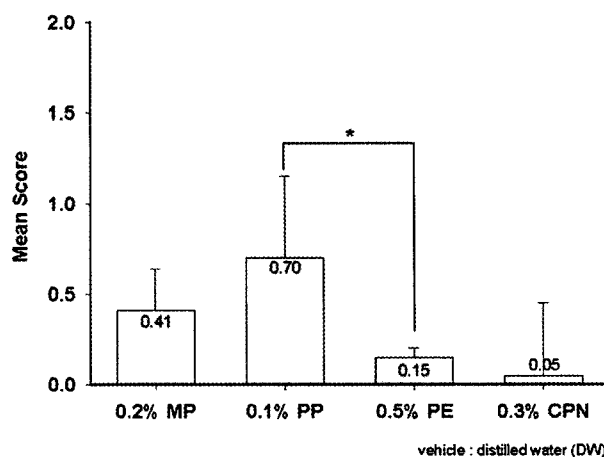


Figure 1. Comparison of sensory irritation potential in several preservatives. * $p < 0.05$. MP = methyl paraben; PP = propyl paraben; PE = phenoxyethanol; CPN = chlorphenesin.

at 10 s and each min for 9 min by using a scale from 0 ~ 3: 0 = none, 1 = slight, 2 = moderate, 3 = severe.

The test material on soaked cotton swab was rubbed briskly and then put on the test site for occlusion. Cosmetic products were applied similarly as real condition of daily use.

Participants were classified as stingers or non-stinger by the application of lactic acid. Classification involved 3 repeat tests of a single application of 5% aqueous lactic acid and distilled water to one side and the other part of the faces. Panelists were then classified into two groups, stinger (more 0.2 mean value of aqueous lactic acid) and non-stinger (less 0.2 mean value of aqueous lactic acid).

2.3. Test Materials

Lactic acid (LA, Sigma Chemicals Co., St. Louis, MO, USA) was prepared in distilled water (DW) at concentration of 5% (w/v) for selection test of stingers. Methylparaben (MP, Hanbit, Korea), Propylparaben (PP, Hanbit, Korea), Phenoxyethanol (PE, Clariant, England) and Chlorphenesin (CPN, Serobilogiques, France) were prepared in various concentrations.

2.4. Statistical Analysis

Statistical analysis was conducted using SPSS for windows computer software (SPSS Science, USA). The values of sensory irritation were statistically analyzed

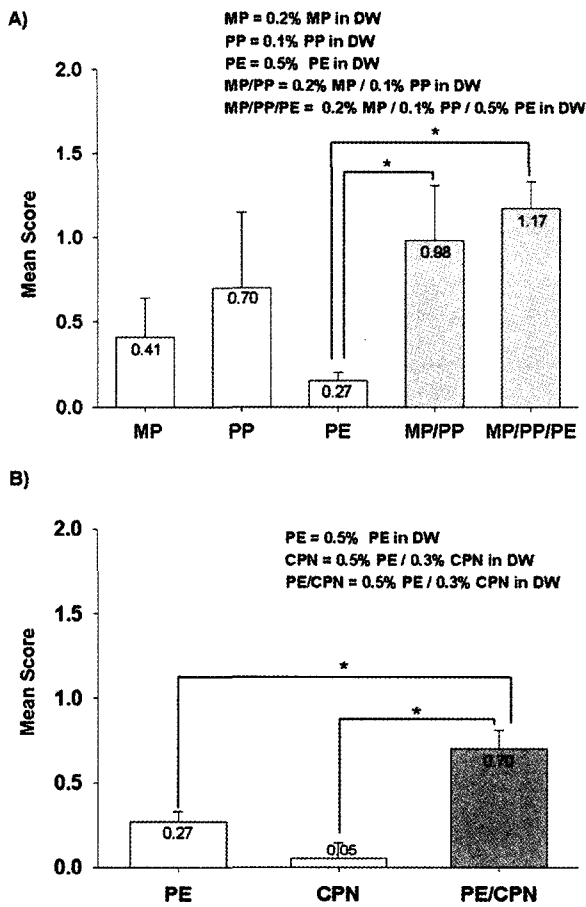


Figure 2. Comparison of effect of combination of preservatives. * $p < 0.05$. MP = methyl paraben; PP = propyl paraben; PE = phenoxyethanol; CPN = chlorphenesin; DW = distilled water.

using ANOVA test. P value < 0.05 was considered significant.

3. Results

3.1. Sensory Irritation Potential in Several Preservatives

The sensory irritation potential of preservative was very different at concentrations mainly used in ordinary cosmetics (Figure 1). Especially, phenoxyethanol and chlorphenesin showed very weak sensory irritation response.

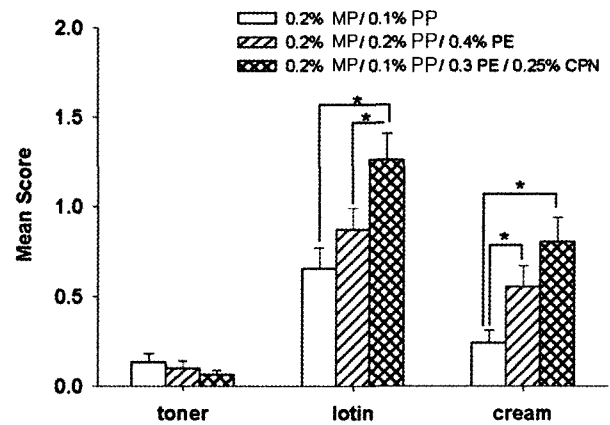


Figure 3. Difference in sensory irritation potential effects formulation and other preservatives. * $p < 0.05$. MP = methyl paraben; PP = propyl paraben; PE = phenoxyethanol; CPN = chlorphenesin.

3.2. Sensory Irritation in Combination of Preservatives

Sensory irritation potential by combination of preservatives was demonstrated in Figure 2. While synergistic effect were not prominent in certain preservatives in combination (Figure 2A), phenoxyethanol and chlorphenesin showed marked increase in sensory irritation when combined (Figure 2B).

3.3. Effects in Formulation and other Preservatives

It was shown that sensory irritation potential varies according to change of formulations (Figure 3). The highest irritation effect of combined preservatives was observed in the lotion type and followed by cream and toner.

While toner type was not shown much difference in sensory irritation in 3 different combination of preservatives, they were much more different in lotion and cream types (Figure 3).

4. Discussion

Preservatives are known as one of the most important cosmetic ingredients which can produced sensory irritation. It has been known phenoxyethanol and chlorphenesin were regarded as more safe than parabens in terms of sensory irritation. However in our study sensory irritation potential of phenoxyethanol was chan-

ged in certain condition, combination of preservative and change of formulation.

Phenoxyethanol and chlorphenesin themselves have weak sensory irritation potentials, however we observed phenoxyethanol combined with chlorphenesin synergistically increase of sensory irritation potentials, we think it is significant when we select preservatives.

It is known that acid condition of lactic acid increases sensory irritation more than in alkaline condition. But we found that pH value do not relate to sensory irritation of preservatives (data not shown).

Our data indicate that there is difference in sensory irritation potential according to the type of formulations. We have found the variation of subjective irritation did not very so much in toner type, while marked variations were noticed in lotion and cream type. It is thought that occlusive factor may be related to that phenomenon.

5. Conclusion

In conclusion, this study indicates that several important factors should be considered to reduce the unwanted sensory irritation due to preservatives: the concentration, formulation type and combination of preservatives.

In further study we will show several factors in

formulation influencing sensory irritation of preservatives. This research will assist to develop cosmetics with very low sensory irritation potential of preservatives in products.

References

1. A. M. Kligman, The invisible dermatoses, *Arch Dermatol*, **127**, 1375 (1991).
2. Fisher, Cosmetic actions and reactions: Therapeutic, irritant and allergic. *Cutis*, **26**, 22 (1980).
3. F. Masashi, Advanced research of skin sensory stimulation, *Fragrance J.*, **2**, 75 (1995).
4. E. Y. Lee, S. S. An, S. J. Moon, and I. S. Chang, The development of new and sensitive method of subjective irritation and the evaluation of preservatives (Oral presentation), *2nd Int'l Acad. Cosmet. Dermatol.* (2000).
5. J. F. Petter and M. K. Albert, A method for apprising the stinging capacity of topically applied substances, *J. Soc. Cosmet. Chem.*, **28**, 197 (1977).
6. M. Christensen and A. M. Kligman, An improved procedure for conducting lactic acid stinging tests on facials skin, *J. Soc. Cosmet. Chem.*, **47**, 1 (1996).
7. F. Masahi, O. Yuri, and M. Hitoshi, Skin sensory stimulation, *J. Soc. Chosmet. Chem., Japan*, **22**, 229 (1989).