Asian Skin: Its Architecture, Function and Differences from Caucasian Skin

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Key words

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Abstract

There are differences between Asian skin and the skin of other races. There also differences in the skin characteristics of Asian subpopulations. These differences are important for development of new products and therapies.

Racial and genetic factors may play a pivotal part in the variability of an individual's response to topicals and cosmetics. Studies on the racial differences of skin physiology and function have been mainly focused on the differences between Black and White skin with little emphasis placed on Asian skin.

Asian skin belongs mainly to people of the Mongoloid group, which includes the Chinese and Malays. People from India belong to the Caucasoid group, although those who come from southern India have black skin that bears more resemblance to the skin of the Negroid group.

In the increasingly important global cosmetic market, and with the opening of markets in China and other parts of Asia, knowledge of the similarities and differences of the various skin types will be of increasing importance. There have been few and conflicting studies comparing the differences between Caucasian and Asian skin. We will examine the evidence and share our own experience on this issue.

Singapore has a unique population composed principally of ethnic Chinese, with two big minority groups (Malays at 17% and Indians at 10%) and a smaller group of Caucasians and Euroasians. This racial variety has enabled us to conduct several studies on skin physiology and structure in the different ethnic groups in Asia.

Stratum Corneum

The stratum corneum is made up of cornified cells, with the intercellular region composed of lipids and desmosomes. It plays a crucial role in barrier function and impacts on occurrence of irritant reactions and absorption. Because the stratum corneum acts as the barrier to the outside environment, any racial differences in the function of this layer may have a major impact on transcutaneous penetration of chemicals.

One study[1] of Asian, Black and Caucasian skin showed no significant differences in corneocyte size. It also showed that desquamation of the stratum corneum was the same between Asians and Caucasians, but greater in Blacks.

Transepidermal water loss (TEWL) reflects the integrity of the barrier function of the stratum corneum. Several small-scale studies comparing TEWL between Asians and Caucasians did not demonstrate any significant differences in basal TEWL between the different races. Most researchers agree that basal measurements of TEWL do not correlate with the ability of the stratum corneum to function under conditions of skin irritation and adverse occupational environments. Therefore, several studies have examined the TEWL of the skin after acute and cumulative skin irritation with chemicals of varying reactivity, in Asians as well as in Caucasian subjects.

Goh and Chia found no significant differences in TEWL in irritated and non-irritated skin of the different Asian subgroups – Chinese, Malays and Indians.[2]

The transdermal penetration of nitroglycerine in Black, Caucasian and Asian patients was examined by Williams et al.[3] They found that the mean plasma concentrations of nitroglycerin and its metabolite were significantly lower in Blacks, compared to the levels in Asian and Caucasian patients.

Kompaore et al.[4] evaluated the stratum corneum function of Blacks, Caucasians and Asians in vivo, using laser Doppler velocimetry to evaluate the lag time before vasodilation induced by application of methyl nicotinate, a local vasodilator drug. TEWL was also determined before and after tape strippings

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of the stratum corneum. There were 7 Blacks, 8 Caucasians and 6 Asians in this study. The results showed that skin permeability was higher in Asians and Caucasians than in Blacks. After 8 to 12 strippings, the order of sensitivity was Asian>Caucasian>Black.

In another study of TEWL after tape stripping in a small group of Caucasian and Asian subjects, Reed et al.[5] found no difference in barrier perturbation and recovery, although it was noted that subjects of darker skin showed superior barrier function after tape stripping.

We performed a study on skin barrier function and integrity in different subpopulations of healthy Asian skin (unpublished data). Included in the study were 10 Chinese, 10 Malays, 10 Indians and 10 Caucasians. TEWL and laser Doppler perfusion imaging (LDPI) measurements were measured at baseline, after tape stripping and during recovery 3 hours after tape stripping. Barrier integrity was assessed by counting the number of tape strippings required to cause average TEWL of 20 g/m^2/hr, which is considered a significant impairment of stratum corneum. There was no statistically significant difference in barrier function and integrity between the races or between different skin types.

Epidermis

Function: The epidermis lies just beneath the stratum corneum and is important for the generation of the stratum corneum. Other important functions of the epidermis include metabolism of substrates, including generation of lipids and proteins of the stratum corneum and synthesis of melanin from melanocytes for photo protection.

Skin pigmentation: The melanocyte plays a major role in distinguishing colored races. The difference in skin color is determined by the amount of melanin and its distribution within the epidermis. Between the different races, however, there is no difference in the number of melanocytes.

The racial difference in color is due to the differences in the aggregation, size and number of melanosomes found in the melanocytes and keratinocytes. In Blacks, the melanosomes are dispersed individually and only a few are found in aggregates. The melanosomes in Blacks are also larger in size. In contrast, melanosomes in Caucasian and Mongoloid skin are grouped in aggregates, and the aggregates tend to be more compact in Mongoloids than in Caucasians. Even within the Asian skin type, there are skin subtypes that differ in their composition of melanosomes. The larger, non-

Racial Differences in Skin Structures and Function: Asians versus Caucasians

Stratum corneum	No significant differences in basal function, recovery or integrity
Epidermis	Higher incidence of pigmentary disorders (eg. melasma) in Asians versus Caucasians
Dermis	Higher incidence of keloids among Chinese, compared to other Asians or Caucasians
Sebaceous glands	Higher sebum secretion in Chinese than in Caucasians
Hair	Lower hair density in Koreans than in Caucasians
Nerves	No significant differences in pain perception and skin sensitivity to irritation

aggregated melanosomes offer greater protection from UV and skin malignancy.

Melanosomes in Blacks are distributed throughout the epidermis from the stratum basale to the stratum corneum. A study on Thai subjects[6] found similar distribution thoughout the epidermis. This pattern of distribution differs from that of Caucasian subjects, where the melanosomes are found mainly in the stratum basale and are absent in the outer layers of the epidermis.

Clinical application: Several pigmentation disorders are typically seen in Asian skin. Melasma in females is one example. A recent study in Korean skin[7] found that each subject had more melanin in melasma lesions than in the normal skin throughout the epidermis, including the stratum corneum.

Mongolian spots are blue-black macules that appear frequently on the back after birth and are seen in up to 90% of Asians and less frequently in Blacks and Caucasians. Naevus of Ota, which is a congenital pigmentary patch, and cafe au-lait spots are also more frequently seen in Asians.

The Dermis

The dermis is comprised mainly of collagen fibers and elastic tissue that provides the structural framework for this layer. The dermis contains an extensive network of vessels essential for its role in thermal regulation, skin nutrition and repair and immune response. Within the dermis are the appendages of the skin: the hair follicles, sebaceous, sweat and apocrine glands.

The nerve network of the skin is made up of somatic and sympathetic autonomic fibers. This network is also found within the dermis and penetrates to the epidermis.

There are no published studies comparing the dermis in Asians. However, keloids, which are an exuberant form of scar formation, are more common in Asians than in Caucasians. Fibroblast hyperactivity and a decrease in collagenase enzyme activity are believed to be important factors in the formation of keloids.

There are racial differences in keloid formation. Blacks and Asians are known to be more susceptible to development of keloid scarring.[8] In a study among Chinese, Malays and Indians, keloid scarring was found to be more common among the Chinese population.[9] In our experience, keloid scarring has also been found to occur more often in the Chinese population than with the Malays and Indians.

Sebaceous glands: The sebaceous glands are attached to the hair follicles and are responsible for sebum production. There have been conflicting reports on the differences in sebum production in the different races. In a study[10] on 60 White, Black and Asian subjects, there was no statistically significant difference in the rate of sebum secretion among the different races.

However, we recently conducted a pilot study comparing sebum measurements in age- and sex-matched Asians and Caucasians. Sebum secretion was significantly higher in Asian skin than in Caucasian skin. This has possibly resulted in a higher incidence of acne vulgaris in Asians. It is our observation that Asians also often complain of oily scalp.

Hair: Differences exist in hair among the races. Asian hair is more circular and of a larger cross sectional area than the hair Caucasian subjects.[11]

A recent study compared the hair of Koreans, Whites and Blacks.[12] Koreans had significantly lower hair density than either Whites or Blacks.

Nerves and skin perception: Perception of pain and skin irritation is affected by many factors, including genetic, cultural and ethnic issues. The effect of these factors on pain perception is not well understood. It is often believed that different ethnic populations have different levels of pain threshold tolerance, but this has never been quantified.

A recent study (unpublished data) of 20 Chinese, 14 Malay and 15 Indian subjects measured thermal pain thresholds with computerized quantitative thermal sensory testing[13] before and after barrier perturbation with tape strippings. No differences in thermal pain perception before and after barrier perturbation were found between the different races and skin types. Future studies may investigate whether pain tolerance, which is the maximum stimulus a subject will tolerate over a specified period of time, differs in different subgroups of Asians.

Conclusions

The skins of Asians, Caucasians and Blacks show racial differences.There are also skin differences among the different Asian subpopulations. Understanding the similarities and differences in the architecture and function of Asian skin will enable us to develop and prescribe new therapies in a more focused and rational way.

References

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1. P Corcuff, C Lotte, A Rougier and HI Maibach, Racial differences in corneocytes. A comparison between black, white and oriental skin, *Acta Dermatovenereologica* 71 146-148 (1991)
2. CL Goh CL and SE Chia, Skin irritability to sodium lauryl sulphate as measured by skin water vapour loss- by sex and race, *Clin Exp Dermatol* 13 16-19 (1988)
3. RL Williams, KM Thakker, V John, ET Lin, W Liang-Gee W and LZ Benet, Nitroglycerin absorption from transdermal systems: Formulation effects and metabolite concentrations, *Pharm Res* 8 744-749 (1991)
4. F Kompaore, JP Marty and C Dupont, In vivo evaluation of the stratum corneum barrier function in Blacks, Caucasians and Asians with two noninvasive methods, *Skin Pharmacol* 6 200-207 (1993)
5. JT Reed, R Ghadially and PM Elias, Skin type, but neither race nor gender, influence epidermal permeability barrier function, *Arch Dermatol* 131 1134-1138 (1995)
6. R Kotrajaras and AM Kligman, The effect of topical tretinoin on photodamaged facial skin: the Thai experience, *Br J Dermatol* 129 302-309 (1993)
7. WH Kang, KH Yoon, KS Lee, J Kin, KB Lee and H Yim, Melasma: Histopathological characteristics in 56 Korean patients, *Br J Dermatol* 146 228-237 (2002)
8. SS Urioste, KA Arndt and JS Dover, Keloids and hypertrophic scars: Review and treatment strategies, *Seminars in Cutaneous Medicine and Surgery* 18 159-171 (1999)
9. SC Taylor, Skin of color; Biology, structure, function and implications for dermatologic disease, *J Am Dermatol* 46 S41-62 (2002)
10. SK Abedeen, M Gonzalez, H Judodihardjo, S Gaskell and P Dykes, Racial variation in sebum excretion rate. Program and abstracts of the 58th Annual Meeting of the American Academy of Dermatology, March 10-15, 2000, in San Francisco (Abstract #559)
11. DG Vernall, Study of the size and shape of hair from four races of men, *Am J Phys Anthropol* 19 345 (1961)
12. HJ Lee, SJ Ha, JH Lee, JW Kim, HO Kim and DA Whiting, Hair counts from scalp biopsy specimens in Asians, *J Am Acad Dermatol* 46 218-221 (2002)
13. G Yosipovitch and HI Maibach, Evaluating subjective irritation and sensitive skin, *Cosmet Toil* 114(1) 41-42 (1999)

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