Mandom has confirmed that "visibility of pores" and "dullness of skin" affect appearance and cause in the evening "a tired look" on faces of women aged around 40 years.

～ Analyzing the causes of "looking tired in the evening", that many women worry, from the aspect of the skin appearance characteristics ～

Mandom Corporation (hereafter, called Mandom; headquartered in Osaka city; President Executive Officer & Director Motonobu Nishimura) is working on the skin impression research for the purpose of supplying the skincare products that improve impression formed by appearance. Although the research had focused on men before, Mandom is now conducting the research focusing also on women's impression formed by their appearance in order to supply the skincare products for them.

This time, Mandom focuses on "a tired look on women's faces in the evening" that more than 60% of women aged around 40 years worry particularly (Fig. 1).

After analyzing the skin color data based on the images of faces, Mandom realized that "the skin color that was dark and irregular" tended to give the impression of being tired. When difference in impression between the face in the morning and the face in the evening, that was related directly to women's worries, was evaluated next, 32 out of 34 women looked more tired in the evening compared with them in the morning. Then, Mandom conducted a correlated analysis focusing on the change in visible skin conditions (skin appearance characteristics) between the face in the morning and the face in the evening (hereafter "shift amount") and identified "visibility of pores" and "dullness of skin" as the causes of a tired look on their faces in the evening that deteriorate their appearance.

Results of this research will be presented in the 24th JFACE Annual Conference (Forum Kaogaku 2019) held on September 14 and 15, 2019.

1. "Face looks tired" when "its skin color is dark and irregular."

Images of the faces of 34 women aged around 40 years (between 35 and 45) were taken (two images per person i.e. an image of the face in the morning and an image of the face in the evening) and those images[*1] were shown to third-party 36 men and women aged between 21 and 49. They rated the images according to "the impression of looking tired" and "the skin appearance characteristics (visibility of pores, healthy skin color, etc." (Table 1).

In regard to the correlation between "Face looks tired" and "the skin appearance characteristics" such as "Skin is bright", "Skin has tension" and "Skin seems to be moisture" showed high negative correlation and "Skin looks dull" showed high positive correlation. As coefficients of correlation between them were high (all the absolute values of correlation coefficients were 0.7 or more), appearance-related common features seemed to be present. Then, regarding cheeks of the face images, total 6 values (Table 2) i.e. average values of the skin color data L*, a* and b* and standard deviations of L*, a* and b* were calculated (based on the histogram data of Adobe Photoshop's L*a*b* color mode) and correlation with the scores of the abovementioned 4 types of skin appearance characteristics was checked. As a result, high negative correlation with average value of L* (brightness) and high

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positive correlation with standard deviations of a* and b* (irregularity of redness and irregularity of yellowness) (Fig. 3, graphs representing the skin color data having the highest correlation with each of the skin appearance characteristic scores) were commonly seen among the skins that look tired. In other words, the faces that look tired were found to have the skin with dark and irregular color.

2. Faces of 32 out of 34 women looked tired in the evening compared with their faces in the morning and "their faces' impression of being tired" in the evening were caused by the changes in the skin appearance characteristics such as "visibility of pores" and "dullness of skin."

Regarding the scores of the impression of "looking tired", the scores of 32 out of 34 women increased when their faces in the evening were compared with the same in the morning. Significant increase was seen also in regard to the average values. Many women worry about "their faces look tired in the evening" and it has become clear that other people also have almost the same impression. However, some skin appearance characteristics showed significant changes and others did not show them and it is considered that changes in skin conditions may vary with individuals.

Therefore, in regard to the women whose impression of looking tired differed significantly between their faces in the morning and the same in the evening, analysis focusing on the difference (shift amount) between the faces in the morning and the evening seemed to be necessary to identify the skin appearance characteristics that had significant changes.

Based on the obtained impression scores of the items in the Table 1, amounts of the impression shift between the 34 women's faces in the morning and their faces in the evening were calculated. The shift amounts of the skin appearance characteristics such as "Pores are visible" and "Skin looks dull" had high correlation with the shift amount of "Face looks tired" (both showed positive correlation as shown in Fig. 4). Accordingly, it is clear that face's impression of looking tired increases when "pores become visible" and "dullness of skin increases" in the comparison between the skin's appearance in the evening and the same in the morning.

As mentioned above, it has been clear that "face's impression of looking tired" of the women aged around 40 years is related to the states of skin's appearance and the changes in the skin appearance characteristics such as "visibility of pores" and "dullness of skin" from morning to evening have effects on "a tired look on the face in the evening" that is one of major concerns related to skin.

Based on the above knowledge, Mandom will develop further research and apply the results to the development of the skincare products that solve women's concern about "face's impression of looking tired."

*1: Images of the faces of 34 women aged around 40 years (between 35 and 45 years) were taken by using the VISIA Evolution manufactured by Canfield Scientific. Two images i.e. an image of the face in the morning and an image of the face in the evening were taken per person. The first image was taken in the morning when 50 minutes have passed after washing a face and skin has acclimated. The second image was taken when 9 hours have passed after taking the first image. All the subjects conducted the designated fatiguing and burdening operations during the waiting time.

< Reference materials >

Fig. 1. Research data regarding a tired look on face (A survey by Mandom in March 2018 targeted women aged between 30 and 59, n = 10,000)

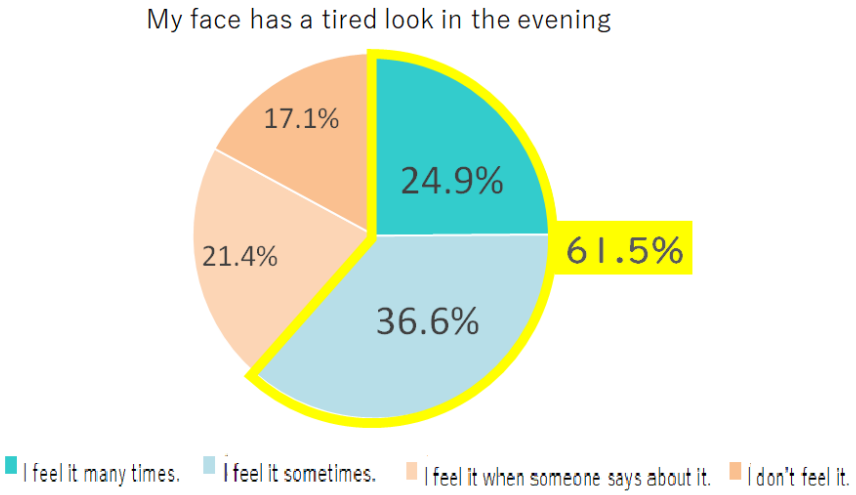


Table 1. Items rated by the third party (with the points between 0 and 100 for each item)

Face impression item	Face looks tired.
Skin appearance characteristics	Pores are visible. Skin has healthy color. Skin is bright. Skin looks dull. Skin has tension. Skin seems to be moisturized. Dark circles under the eyes are visible.

Fig. 2. Correlation between the impression of "looking tired" and the scores of the skin appearance characteristics

From the left, scores of brightness (R = -0.80), scores of tension (R = -0.78), scores of moisture (R = -0.75), scores of dullness (R = 0.79)

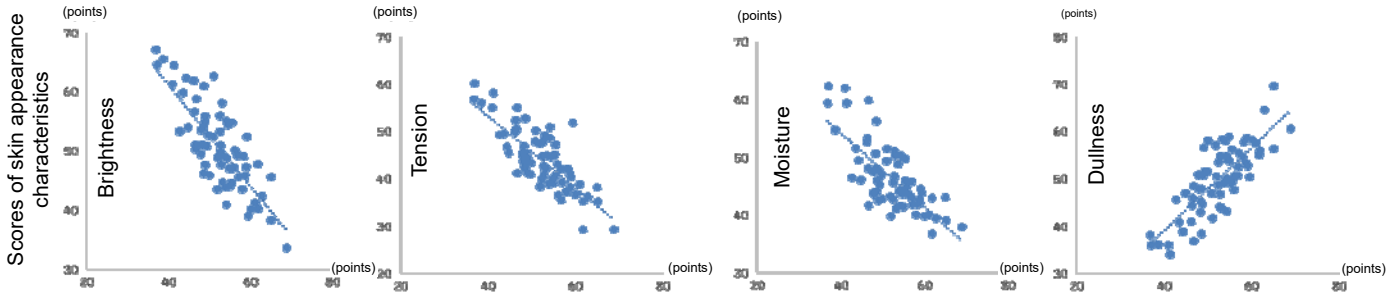


Table 2. Meaning of skin color data

Skin color data	Characteristic of skin color when the value is large
*L** average value	Bright
*L** standard deviation	Irregularity of brightness
*a** average value	Reddish
*a** standard deviation	Irregularity of redness
*b** average value	Yellowish
*b** standard deviation	Irregularity of yellowness

Fig. 3. Skin color data: Correlation of the skin color data that showed the highest correlation with each of the skin appearance characteristic scores

From the left, brightness score and L* average value (R = 0.51), tension score and a* standard deviation (R = -0.48), moisture score and b* standard deviation (R = -0.44), dullness score and b* standard deviation (R = 0.52)

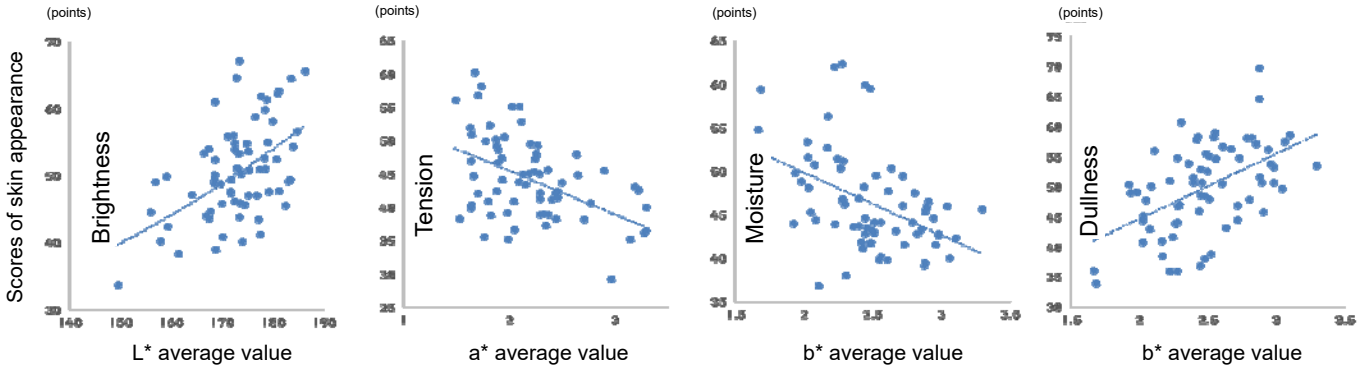
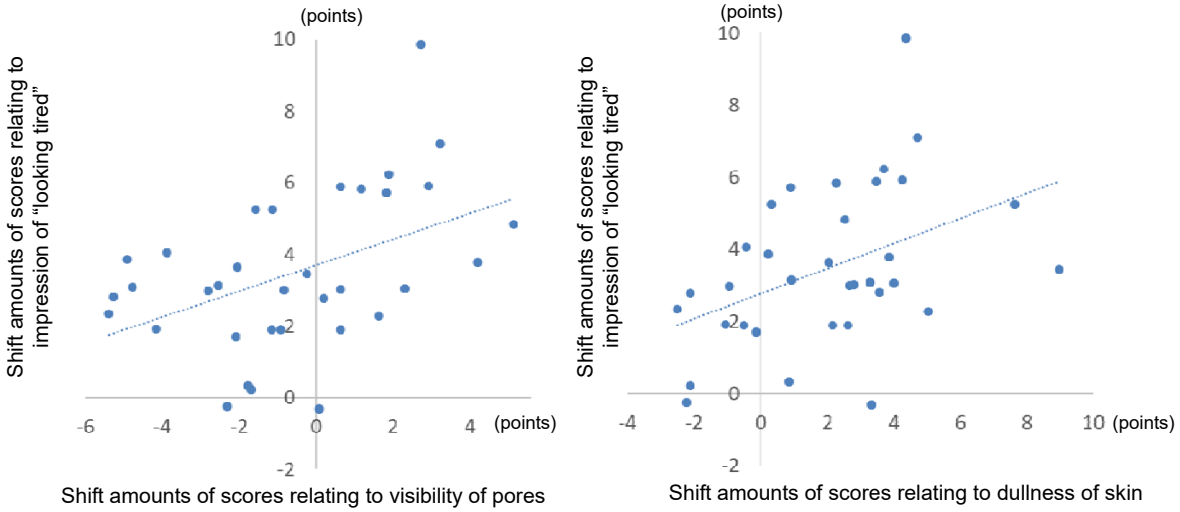


Fig. 4. Correlation in the shift amount relating to the impression in the morning and the same in the evening
Left: Scores relating to impression of “looking tired” and scores relating to visibility of pores (R = 0.46)
Right: Scores relating to impression of “looking tired” and scores relating to dullness of skin (R = 0.43)



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