Objective research on tongue manifestation of patients with eczema

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Abstract.
BACKGROUND: Tongue observation often depends on subjective judgment, it is necessary to establish an objective and quantifiable standard for tongue observation.
OBJECTIVE: To discuss the features of tongue manifestation of patients who suffered from eczema with different types and to reveal the clinical significance of the tongue images.
METHODS: Two hundred patients with eczema were recruited and divided into three groups according to the diagnostic criteria. Acute group had 47 patients, subacute group had 82 patients, and chronic group had 71 patients. The computerized tongue image digital analysis device was used to detect tongue parameters. The $L^*a^*b^*$ color model was applied to classify tongue parameters quantitatively.
RESULTS: For parameters such as tongue color, tongue shape, color of tongue coating, and thickness or thinness of tongue coating, there was a significant difference among acute group, subacute group and chronic group ($P < 0.05$). For Lab values of both tongue and tongue coating, there was statistical significance among the above types of eczema ($P < 0.05$).
CONCLUSIONS: Tongue images can reflect some features of eczema, and different types of eczema may be related to the changes of tongue images. The computerized tongue image digital analysis device can reflect the tongue characteristics of patients with eczema objectively.

Keywords: Tongue manifestation, computerized tongue image digital analysis device, eczema, objective research

1. Background

Tongue observation is an important diagnostic skill in the four diagnostic methods in Traditional Chinese medicine (TCM), which include looking, listening and smelling, asking, and touching. According to Traditional Chinese Medicine (TCM) theory, the tongue mirrors the viscera. It can help evaluate the body health state, moreover, it can give objective basis on the manifestation of the disease. Recently there were some clinical reports demonstrate that tongue manifestation such as tongue color, tongue coating, tongue shape, etc. can reflect some features of disease, and was closely associated with some diseases [1–4]. Through observing tongue images, it can help doctors to observe progression of disease, evaluate prognosis, confirm clinical stages, and make syndrome differentiations [5–8].

However, observation diagnosis in TCM often depends on subjective judgment, especially for tongue observation, which is more dependent on light sources, personal experience, and clinical diagnostic

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skills. Moreover, there is not any existing standard which is unquestioned and quantifiable until now. Different TCM doctors may have different diagnostic results on the same tongue, even though a TCM doctor may get different diagnostic results on the same tongue if it was observed at different period of time. Therefore, in order to assist TCM practitioners to achieve objective and reliable diagnosis, it is necessary to establish an objective and quantifiable standard for tongue observation. It needs to combine TCM theory of tongue diagnosis with clinical practice systematically, and apply modern scientific methods and devices to get objective, reliable, and quantified data. Hence some TCM or engineering experts and scholars have been developing computerized tongue diagnostic methods and devices recently [9–15]. Among such modern diagnostic techniques, computerized imaging system is one of the commonly used devices for tongue observation and data analysis.

Eczema is a common hypersensitive and inflammatory dermatosis which may attack people of all ages, either occurring all over the body or being confined in certain parts. Clinically, it is classified into three types: acute eczema, subacute eczema and chronic eczema. In order to avoid the side effect of west medicine, Chinese medicine was widely used in the clinic. Because all the Chinese medicine treatment were based on syndrome differentiation, so how to make a precise diagnosis is a key point. Inspection of tongue manifestation is a mainly used diagnostic method in clinical and plays an important role in syndrome differentiation. In this study, computerized tongue image digital analysis device was used to acquire tongue images and calculate the images. Based on tongue pictures acquisition and data analysis, tongue parameters of different types of eczema patients were compared so as to lay a foundation for the establishment of diagnostic standard of tongue for eczema.

2. Methods

2.1. Criteria of diagnosis

Inclusion criteria was referred to the "Standardized Diagnosis and Treatment of Chinese Medicine Disease and Syndrome" [16] set by the State Administration of Traditional Chinese Medicine, P. R. C.

2.2. Clinical data and grouping

From September 2011 to March 2012, a total of 200 eczema patients were recruited from the first Hospital Affiliated to Tianjin University of TCM. There were 117 male and 83 female cases. The youngest was 8 years old, while the oldest was 87, with the mean age 54.7 ± 16.9 years old.

According to diagnostic criteria, 200 patients were divided into three groups which were acute eczema group (acute, 47 cases), subacute eczema group (subacute, 82 cases), and chronic eczema group (chronic, 71 cases).

2.3. Qualitative indices

The tongue pictures of acquisition were analyzed from four aspects which included color of tongue (pale, pink, red, crimson and blue purple), tongue shape (size and teeth marks), color of tongue coating (white, light yellow and yellow), and texture of tongue coating (thinness, thickness and no coating).

2.4. Quantitative detection indices

The computerized tongue image device was provided by the School of Chinese Medicine and

Table 1
Comparison of tongue body colors in different eczema types (case, %)

Group	Case	Pale	Pink	Red	Crimson	Blue purple
Acute	47	15 (31.91)	2 (4.88)	21 (44.68)	6 (12.77)	3 (6.38)
Subacute	82	39 (47.56)[a]	11 (13.41)	26 (31.71)[a]	3 (3.66)	3 (3.66)
Chronic	71	33 (46.48)[a]	9 (12.68)	25 (35.21)[a]	2 (2.82)	2 (2.82)

[a]: $P < 0.05$, compared with acute.

Engineering, Tianjin University of TCM. It was a digital analysis system which was made up of two parts, the hardware part was composed of a Nikon D80 DSLR (digital single lens reflex camera), lens and computer, and the software part was formed by data analysis system of tongue image.

L*a*b* three-dimensional color model was applied for standard color measurement. "L" stands for the changes from blackness (0) to whiteness (100), "a" represents the changes from red color to green color, while "b" indicates the changes ranging from yellow color to blue color.

2.5. Statistical analysis

SPSS 13.0 software package for windows were used to analyze data, and bilateral t test was adopted at a common level of significance $\alpha = 0.05$. All collected data were shown in the form of mean 1 standarddeviation. The statistical differences were accepted as $P < 0.05$.

3. Results

3.1. Overall distribution of all kinds of tongue manifestations

Groups of different colors of tongue: pink was 11% (22/200), pale 43.5% (87/200), red 36% (72/200), crimson 5.5% (11/200), blue purple 4% (8/200); Groups of different tongue shape: enlarged tongue 49% (98/200), normal size tongue 33% (66/200), small size tongue 18% (36/200), teeth marks 51% (102/200); Groups of no coating 2.5% (5/200), thin coating 46.5% (93/200), group of thick coating 51% (102/200); Groups of different tongue coating colors: white 61% (122/200), light yellow 21.5% (43/200), yellow 17.5% (35/200).

3.2. Comparison of tongue body colors in different eczema types

Result is shown in Table 1. Among 87 patients of pale tongue, 15 had acute eczema, 31.91% of acute eczema group, while 39 patients with subacute eczema for 47.56% of subacute eczema group and 33 patients with chronic eczema for 46.48% of chronic group, showing significant difference between acute eczema group and the subacute, chronic groups ($P < 0.05$). Among 72 patients of red tongue, 21 had acute eczema, 44.68% of acute eczema group, while 26 patients with subacute eczema for 31.71% of subacute eczema group and 25 patients with chronic eczema for 35.21% of chronic group, showing significant difference between acute eczema group and subacute, chronic groups ($P < 0.05$).

3.3. Comparison of tongue shape in different eczema types

Result is shown in Table 2. Among 98 patients of enlarged tongue, 56 had subacute eczema, 68.29%

Table 2
Comparison of tongue shape in different eczema types (case, %)

Group	Case	Normal	Enlarged	Small	Teeth mark
Acute	47	17 (36.17)	21 (44.68)[a]	9 (19.15)	13 (27.66)
Subacute	82	18 (21.95)	56 (68.29)[a]	8 (9.76)	68 (82.93)[b]
Chronic	71	31 (43.66)	21 (29.58)	19 (26.76)	21 (29.58)

[a]: $P < 0.05$, compared with chronic. [b]: $P < 0.05$, compared with acute and chronic.

Table 3
Comparison of tongue coating colors in different eczema types (case, %)

Group	Case	White	Light yellow	Yellow
Acute	47	3 (6.78)	12 (25.53)	32 (68.09)
Subacute	82	63 (76.83)[a]	17 (20.73)	2 (2.44)[a]
Chronic	71	56 (78.87)[a]	14 (19.72)	1 (1.41)[a]

[a]: $P < 0.05$, compared with acute.

Table 4
Comparison of texture of tongue coating in different eczema types (case, %)

Group	Case	No coating	Thin	Thick
Acute	47	1 (2.13)	16 (34.04)[a]	30 (63.83)[a]
Subacute	82	2 (2.44)	35 (42.68)[a]	45 (54.88)[a]
Chronic	71	2 (2.82)	14 (59.15)	27 (38.03)

[a]: $P < 0.05$, compared with chronic.

of subacute eczema group, and 21 patients with acute eczema for 44.68% of acute eczema group, while 21 patients with chronic eczema for 29.58% of chronic group, showing significant difference between the former two groups and chronic eczema group ($P < 0.05$). Among 102 patients of teeth marks tongue, 68 had subacute eczema, 82.93% of subacute eczema group, while 13 patients with acute eczema for 27.66% of acute eczema group and 21 patients with chronic eczema for 29.58% of chronic group, showing significant difference between subacute eczema group and acute, chronic groups ($P < 0.05$).

3.4. Comparison of tongue coating colors in different eczema types

Result is shown in Table 3. Among 122 patients of white tongue coating, 3 had acute eczema, 6.38% of acute eczema group, while 63 patients with subacute eczema for 76.83% of subacute eczema group and 56 patients with chronic eczema for 78.87% of chronic group, showing significant difference between acute eczema group and subacute, chronic groups ($P < 0.05$). Among 35 patients of yellow tongue coating, 32 had acute eczema, 68.09% of acute eczema group, while 2 patients with subacute eczema for 2.44% of subacute eczema group and 1 patient with chronic eczema for 1.41% of chronic group, showing significant difference between acute eczema group and subacute, chronic groups ($P < 0.05$).

3.5. Comparison of texture of tongue coating in different eczema types

Result is shown in Table 4. Among 93 patients of thin coating, 42 had chronic eczema, 59.15% of chronic eczema group, while 16 patients with acute eczema for 34.04% of acute eczema group and 35 patients with subacute eczema for 42.68% of subacute group, showing significant difference between chronic eczema group and acute, subacute groups ($P < 0.05$). Among 102 patients of thick coating, 27 had chronic eczema, 38.03% of chronic eczema group, while 30 patients with acute eczema for 63.83%

Table 5
Comparison of tongue body color lab values in different eczema types (x ± s)

Group	Case	L	a	b
Acute	47	59.47 ± 2.15	15.81 ± 1.13	7.58 ± 1.34
Subacute	82	67.38 ± 2.31[a]	11.99 ± 1.22[a]	6.99 ± 1.45
Chronic	71	66.55 ± 2.09[a]	12.68 ± 1.17[a]	7.13 ± 1.27

[a]: $P < 0.05$, compared with acute.

Table 6
Comparison of tongue coating color lab values in different eczema types (x ± s)

Group	Case	L	a	b
Acute	47	61.45 ± 2.77	7.26 ± 1.23	7.97 ± 1.15
Subacute	82	69.26 ± 2.91	7.52 ± 1.09	5.44 ± 1.09[a]
Chronic	71	67.81 ± 2.51	8.03 ± 1.36	5.60 ± 1.29[a]

[a]: $P < 0.05$, compared with acute.

of acute eczema group and 45 patients with subacute eczema for 54.88% of subacute group, showing significant difference between chronic eczema group and acute, subacute groups ($P < 0.05$).

3.6. Comparison of tongue body color lab values in different eczema types

The results in Table 5 showed that tongue colors had different "Lab" values in different eczema types. "L" values in acute type were significantly different from those in subacute type and chronic type ($P < 0.05$). "a" values in acute type had significant difference from those in the other two types ($P < 0.05$).

3.7. Comparison of tongue coating color lab values in different eczema types

The results in Table 6 showed that tongue coating colors had different "Lab" values in different eczema types. "b" values in acute type were significantly different from those in subacute type and chronic type ($P < 0.05$).

4. Discussion

This study enrolled 200 eczema patients, collected information on the tongue with computerized tongue image digital analysis system to ensure its objectivity. The results of this study indicated that both the subjective parameters such as color of tongue, color of tongue coating, texture of tongue, thinness or thickness of coating, and some objective parameters such as Lab values in different types of eczema were quite different, although the patients suffered from the same kind of disease, eczema. The experimental data also indicated that tongue manifestations were quite different in different eczema types, and these kinds of differences were an important aspect of syndrome differentiation according to TCM theory.

This study demonstrated that most patients with acute eczema had pale or red tongue but with yellow coating which indicates damp heat as the main pathogenic factor, while the patients with subacute eczema usually had pale puffy tongue with teeth marks and the tongue coating was thin or thick with white color, which indicates spleen deficiency with dampness retention. For the chronic eczema, the tongue manifestation had some features like normal or puffy or small size of the tongue body, pale or

red color of tongue body, white color of tongue coating, which shows blood deficiency may be involved during the development of the disease.

The International Commission on Illumination recommended to use Lab color model to detect the lightness of color. We measured tongue Lab values indifferent eczema types, and the data analysis showed there was statistical significance in three eczema types. For tongue body colors, there was a statistical significance of "L" and "a" values between acute type and subacute, chronic type. These results were in accordance with those of tongue body colors in different eczema types. For tongue coating, there was a statistical significance of "b" values between acute type and subacute, chronic type. In $L^*a^*b^*$ model, "b" represents the changes ranging from yellowness to blueness, "b" value in acute eczema group is higher than the other two groups showed the color of tongue coating in acute eczema group is more yellowish than the other two groups. This result was quite similar to that of tongue coating colors in different eczema types. By analyzing these results, we can draw a conclusion that $L^*a^*b^*$ model can reflect the tongue manifestation objectively and can be used in computerized tongue image digital analysis system.

5. Conclusion

In this study, the computerized tongue image digital analysis system was used to observe the tongue manifestation of eczema patients and provided a reference for computerized technique to apply in Chinese medicine diagnostic field. In order to develop the study of Chinese medicine objectification and standardization, more diseases and cases will be needed for further deep research to promote the credibility and application of computerized diagnostic technique.

Acknowledgments

Conflict of interest

None to report.

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