

Tongue inspection: a protocol to integrate neurology and traditional Chinese medicine

Inspecção da língua: protocolo para integração da neurologia com a medicina tradicional chinesa

Gislaine Cristina Abe¹, Paulo Eduardo Ramos², Sissy Veloso Fontes³,
Márcia Pradella-Hallinan⁴, Acary Souza Bulle Oliveira⁵

RESUMO

Introdução. A inspeção da língua (IL) é importante para o diagnóstico e prognóstico na Medicina Tradicional Chinesa (MTC). Os modelos de avaliação da língua variam nos diversos países, e não existe um modelo sistematizado. **Objetivo:** propor um modelo de avaliação sistematizada para a IL para ser utilizado em neurologia. **Método.** 1) revisão de livros em inglês, português, e espanhol, e artigos em inglês, português, espanhol e francês das bases de dados Pubmed, Lilacs, e Cochrane Library, usando as seguintes palavras-chave: língua, diagnóstico, prognóstico, medicina tradicional chinesa; 2) seleção das principais características da língua; busca por um protocolo de exame para a língua; busca por características relacionadas com avaliação de prognóstico de doenças. **Resultados.** foram encontrados 26 artigos; entretanto, nenhum deles apresentou perfil para o objetivo deste estudo, ou as informações eram imprecisas e vagas. O mesmo ocorreu com os livros ocidentais de MTC, nenhum deles apresentou um protocolo de exame. Assim, um protocolo de IL baseado na MTC foi elaborado, com quatro níveis de gravidade e complexidade. **Conclusão.** um protocolo sistematizado de IL foi elaborado para uso em medicina integrada (medicina ocidental e MTC), eliminando pontos divergentes e simplificando os itens a serem observados durante a IL.

Unitermos. Medicina Tradicional Chinesa, Língua, Diagnóstico, Medicina Integrativa, Neurologia

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Study conducted at the Department of Neurology and Neurosurgery, Department of Clinical Neurology, Division of Neuromuscular Disease Research, and Traditional Chinese Medicine Clinic at the Universidade Federal de São Paulo–UNIFESP, São Paulo, Brazil.

1. MD, MS, Traditional Chinese Medicine Outpatient Clinic, Division of Neuromuscular Disease Research, Department of Neurology, Universidade Federal de São Paulo–UNIFESP, São Paulo-SP, Brazil.

2. PT, PhD, Traditional Chinese Medicine Outpatient Clinic, Division of Neuromuscular Disease Research, Department of Neurology, Universidade Federal de São Paulo–UNIFESP, São Paulo-SP, Brazil.

3. PT, PhD, Department of Neurology, Universidade Federal de São Paulo–UNIFESP

4. MD, PhD, Department of Psychobiology, Universidade Federal de São Paulo–UNIFESP, São Paulo-SP, Brazil.

5. MD, PhD, Division of Neuromuscular Disease Research, Department of Neurology, Universidade Federal de São Paulo–UNIFESP, São Paulo-SP, Brazil.

ABSTRACT

Background. Tongue inspection (TI) is important for diagnosis and prognosis in traditional Chinese medicine (TCM). Tongue evaluation models vary among countries; however, no systematic protocol is in place. **Objective.** To propose a systematic protocol for TI to be used in neurology. **Method.** 1) A review of the books in English, Portuguese, and Spanish, and of papers in English, Portuguese, Spanish, and French retrieved from the databases Pubmed, Lilacs, and Cochrane Library using the following descriptors: tongue, diagnosis, prognosis, traditional Chinese medicine; 2) Selection of the major tongue characteristics; search for a tongue examination protocol, and search for descriptions of features related to prognostic assessment. **Results.** In total, 26 articles were selected; however, none of them provided information pertaining to the object of the present study, or the information was inaccurate and vague. The same occurred with the Western medicine books, as none of them outlined a protocol. A TCM-based TI protocol was prepared, comprising four levels of severity and complexity. **Conclusion:** A systematic TI protocol was created for use in integrative medicine (Western and Chinese medicine), eliminating the divergent points and simplifying the items to be assessed during tongue inspection.

Keywords. Medicine, Traditional Chinese; Tongue; Diagnosis, Integrative medicine; Neurology

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Endereço para correspondência:

Paulo Eduardo Ramos
Rua Estado de Israel, 899, Vila Mariana
04022-000, São Paulo, SP, Brazil
E-mail: pauloramos@163.com

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INTRODUCTION

Tongue inspection (TI) is one of the most important diagnostic and prognostic methods in traditional Chinese medicine (TCM)¹. Inscriptions regarding TI have been found carved on tortoise shells and bones dating from the sixteenth century BC. Ao Shi wrote the first specialized report during the Song dynasty (960-1279). Since 1949, an increasing number of research articles and books on tongue analysis have been published in China, some of which are still used in the country's education system¹.

Several tongue evaluation models can be found in different countries, but a systematic protocol is lacking. Various classification systems for tongue lesions have been proposed in Western medicine; however, consensus has not been reached to date. In addition, the fact that the etiology of certain conditions is unknown hinders the development of a standard classification system². The association of the tongue with neurological diseases has been the object of research by several authors. Multiple case reports have related diseases to certain tongue features. For instance, a relationship between macroglossia and amyotrophic lateral sclerosis (ALS) was reported in a study with two patients³. This is particularly relevant because the typical finding in ALS is tongue muscle atrophy by demyelination of hypoglossal nerve fibers³. Both patients had comorbidities that could explain the enlargement of the tongue based on the TCM theoretical framework (hypothyroidism, diabetes mellitus, gastroesophageal reflux, and vitamin B12 deficiency)⁴. Fasciculations have also been pointed as an important feature in the early diagnosis of ALS, especially when they involve muscles such as the tongue⁵. The exchange of information between Western and Chinese medicine could provide answers and a possibility of treatment for macroglossia, thus reducing patient suffering.

In TCM, motor neuron diseases are related to atrophic syndrome, which is termed Wei 痿, in Chinese. The description and diagnosis of this syndrome include tongue characteristics (TCs), especially color and coating, based on literature descriptions⁶.

A study comparing mice with a mutation for dystonia musculorum and mice without that mutation showed that the tongue of the mice with the mutated

gene had smaller fungiform papillae and fewer taste buds, which suggested that those structures are affected by dystonin⁷. The fungiform papillae appear as reddish dots on the tongue, a feature that is pathophysiologically correlated with dystonia musculorum according to TCM. In another study, the density and size of fungiform papillae were found to be reduced in knockout mice with inactivated BPAG1 locus (dystonin), which results in dystonia musculorum⁸. Dystonin deficiency was shown to reduce the number of taste buds and fungiform papillae in the anterior portion of the tongue⁷.

Several neurological diseases can progress to increased or decreased numbers of papillae (eg. Machado-Joseph disease, Stüve-Wiedemann syndrome, familial dysautonomia, dystonia musculorum, and Behçet's disease) due to insufficient or excessive neurotrophic support⁸.

There are some difficulties with tongue analysis. A study in collaboration with TCM experts to evaluate inter- and intrapractitioner agreement regarding tongue inspection revealed many mistakes and discordant interpretations. It also showed that the definitions found in the literature were vague and inadequate⁹.

Nevertheless, Zhang published their experience in training TCM practitioners, thereby increasing the level of agreement¹⁰. He had identified the variability in diagnostic standards among practitioners of TCM in previous studies (2004 and 2005), which underlines the need for standardization and training to improve the performance of TCM practitioners.

In 2003, our research team initiated a study on the potential application of TCM techniques in neurology, especially for diseases such as ALS and postpolio syndrome. However, we found multiple difficulties in the discussion of the study results. Among the many obstacles, there was a lack of TI standards - a key element in the assessment of TCM results. During that early stage of the research, we conducted a case study addressing the use of acupuncture in Brazilian para-athletes with refractory pain. After acupuncture treatment, the overall pain index improved; however, one athlete did not respond to the treatment. This athlete had a pathological tongue, and we considered the possibility of further aggravation, such as the progression of poliomyelitis (the athlete's underlying disease) to postpolio syndrome due to acupunc-

ture treatment failure and the tongue alterations we had found. A few years later, this athlete died as a result of rapidly progressive liver cancer¹¹.

We proceeded to work on a way to standardize the characteristics and concepts and to organize the TCs according to symptom severity. We found that the literature on the subject was inaccurate in describing TCs. Very often, the information imparted to the students relied on the empirical knowledge of the instructors. Even today, there is a paucity of literature on TI in the West, and the existing literature is based on textbooks and lacking standards. In addition, the atlases with tongue pictures available in the West bring information for specialists only, hence, of no utility to professionals trained in Western medicine. Therefore, in order to advance the studies conducted by our team, it was necessary to design an instrument to standardize the evaluations and define severity criteria regarding TCs from the Western perspective.

The present review is part of a research project including the systematized evaluation of three groups of patients (control, postpolio syndrome, and ALS), which will be reported in a future article.

This review of the literature was conducted to gather the information that supported the design of an instrument to assess TCs, the standardization of the clinical data that were collected thereof, and the conceptualization of all the aspects included in the examination protocol. Many of these concepts were taken from textbooks available in Portuguese and English in Brazil, and some were constructed based on the experience of investigators with training in TCM and neurology. Thus, the selected characteristics are those considered to be relevant to neurological clinical practice, particularly in regard to diseases involving the motor neuron system. In addition to introducing a useful instrument for research, the present study aims to facilitate the exchange of this body of knowledge with the other health professions. To that end, we have addressed TI according to the TCM theory and translated it into the language of Western medicine.

The objective was to propose the systematization of TI for use in research and in multi- and cross-disciplinary care.

METHOD

The project as a whole was approved by the UNIFESP Research Ethics Committee (Protocol No. 0760/11).

1. A review of books printed in English, Portuguese, and Spanish, and a review of the scientific literature indexed in the Pubmed, Lilacs, and Cochrane Library databases in English, Portuguese, Spanish, and French until May 2012, using the following descriptors: tongue, diagnosis, prognosis, traditional Chinese medicine.

2. Selection of the major TCs and respective prognostic descriptions.

3. Development of a systematic examination protocol; selection of tongue features to be described and appraised for inclusion in a systematic clinical examination according to criteria obtained from the literature review, empirical expertise in TCM, and neurological knowledge. The data were described and organized in increasing levels of chronicity and severity based on TCM theory.

RESULTS

We selected 3 books¹²⁻¹⁴ and 26 papers (Table 1). They were assigned to three categories: tongue inspection (17 papers); aspects of tongue, normal or otherwise (7 papers); the tongue as a diagnostic or prognostic parameter (6 papers). Ten papers were used in the text^{1,9,10,15-17,19,21-23}.

This classification allowed us to analyze 1) a systematic model of tongue inspection; 2) information regarding the description of normal TCs, and 3) information concerning prognostic features, in chronological order or increasing degrees of severity.

DISCUSSION

TCM textbooks

We searched all the textbooks on the subject available in Brazil and selected two books in Portuguese and one in English¹²⁻¹⁴ to inform the construction of the protocol. This choice was based on the fact that those books are recommended by the acupuncture and TCM schools in Brazil, and thus can serve as parameters of the

Table 1. *The 26 selected articles referring to tongue inspection according to traditional Chinese medicine -TCM.*

Articles Year of publication	Category*	Summary	Tongue-related information
Chen ZL, 1987 ¹	1, 2	Review of the studies on tongue inspection and authors' contributions over the years to the understanding of this subject; lists TCs and relates them to different syndromes, highlighting severity markers	Presents a large amount of information as well as the lines of study in chronological order
Kim M et al, 2008 ⁹	1	Evaluates inter- and intrapractitioner agreement when assessing TCs in TCM; lists 13 TCM textbooks† with inaccurate descriptions of TCs; concludes that standardization of terms and concepts in tongue studies is warranted	Proposes improved definition of terms to reduce errors resulting from the lack of standards
Zhang GG et al, 2008 ¹⁰	1	The third article by this team; studies the effect of standardized training on increasing agreement between TCM specialists; reports significant increase in agreement after training	Offers no description of the standardization of parameters; mentions two TCM textbooks as references
O'Brien KA et al, 2009 ¹⁵	1	Describes the reproducibility of inspection, palpation, and auscultation in TCM, including the evaluation of tongue body color	Does not describe the examination method
Anastasi JK et al, 2009 ¹⁶	1, 2	The authors investigate the reasoning process in tongue inspection, seeking to understand the cognitive strategies employed to reach a diagnosis, and examines the accuracy of this examination; tests are administered to both experienced and novice practitioners; concludes that there are differences between the examination methods used by the groups, yet both follow a systematic process to make a diagnosis	Enumerates and describes some characteristics of the tongue based on TCM textbooks§ and associates them with a clinical meaning; the inaccurate descriptions found in the literature are maintained
Chen ZL et al, 1982 ¹⁷	2	Evaluates healthy individuals and analyzes the frequencies of alterations in TCs in that population	Does not define or explain the parameters and evaluation method
Su W et al, 2011 ¹⁸	2,3	Analyzes digital photos qualitatively and quantitatively relative to such parameters as tongue body color, coating color, coating thickness	No description of parameters; uses specialized equipment for image capture
Lim KS et al, 2009 ¹⁹	2	Investigates the presence of tongue signs related to bulbar alteration in a sample of normal individuals, including deviated tongue, central furrowing, increased grooving of the tongue and uneven/irregular border, fasciculations and tongue tremor; no central furrowing, increased grooving or fasciculation were observed	Describes some abnormal movements of the tongue based on a neurology textbook
Lin SC et al, 2008 ²⁰	3	Analyzes signs and symptoms of Yin deficiency according to the Society of Integrated Chinese and Western Medicine in China in patients with cancer and rates them based on severity, with an assessment of four-month survival rates; relates tongue parameters to Yin deficiency and to the survival rates of those patients	Lists characteristics linked to prognostic assessment in patients with cancer; does not describe or define concepts or the evaluation methodology
Jiang M et al, 2011 ²¹	3	Analyzes two groups of patients with rheumatoid arthritis—one group treated with Western medicine drugs; the other, with Chinese phytotherapy; compares the outcomes of the clinical treatments and TCs before treatment	Suggests that some TCs could guide treatment with Western medicine or Chinese phytotherapy for improved treatment efficacy
Chen ZL et al, 1986 ²² (not included)	1	Reports the results of studies with electron microscopy, measures of platelet aggregation, methods for assessing tongue color, measures to evaluate tongue blood flow, and a study with animals; enumerates the developments between 1980 and 1986	Does not describe the examination technique or the TCs
Chiu CC, 2000 ²³ (not included)	1	Describes quantitative computerized image analysis of the tongue	Requires equipment for tongue inspection

*Categories: 1 = tongue inspection model; 2 = tongue characteristics; 3 = tongue characteristics and prognosis

Table 1. *Continuation.*

Articles Year of publication	Category*	Summary	Tongue-related information
Pham B et al, 2004 ²⁴ (not included)	1	Introduces a model for computerized analysis of the tongue; enumerates alterations in TCs described in patients with cancer, including tongue body color, coating color, and tongue shape	Requires equipment for tongue inspection
Pang B et al, 2004 ²⁵ (not included)	1	Views the clinical examination as subjective; proposes a computerized tongue examination based on Bayesian networks	Requires equipment for tongue inspection
Zhang GG et al, 2004 ²⁶ (not included)	1,3	Discusses the variability in TI and identification of TCM syndromes; tests the agreement between three TCM specialists in diagnosis and prescription of herbs for treatment of patients with rheumatoid arthritis	Presents no examination protocol nor defines the concepts introduced
Zhang GG et al, 2005 ²⁷ (not included)	1	A follow-up to the first study of this research team; repeats the methodology to assess the degree of agreement between evaluators regarding the syndrome diagnosis, which includes TI, and prescriptions for patients with rheumatoid arthritis	Describes once again the examination standardization and determines agreement regarding the definitions of the parameters evaluated
Zhang H et al, 2005 ²⁸ (not included)	1	Proposes a new system for tongue-based diagnosis using computerized analysis	Requires equipment for TI
Zhang D et al, 2005 ²⁹ (not included)	1, 2	Biometric study to characterize three groups (normal, appendicitis, pancreatitis) in relation to tongue color and coating; the authors used spectrometry based on the achromatic theory and found quantitative differences between the groups regarding the parameters evaluated	Requires equipment for TI
Wu J et al, 2005 ³⁰ (not included)	1	Regards the clinical examination as subjective and proposes an evaluation based on the digital photo of a point on the tongue, using a "watershed transform and active contour model" with computer-aided analysis of results	Does not define or explain the parameters and evaluation method
Liu Z et al, 2007 ³¹ (not included)	1	Analyzes tongue-related information based on spectroscopic images	Requires equipment for TI
Fang F et al, 2009 ³² (not included)	2	Analyzes the tongue coating in patients with hepatitis B using mass spectrometry	Does not describe clinical aspects
Mao J et al, 2009 ³³ (not included)	1, 2, 3	Multicenter study to determine the effect of treatment with TCM on heart failure using tongue and pulse evaluation as parameters	Ongoing study; presents no clinical evaluation protocol
Lu A-P et al, 2009 ³⁴ (not included)	3	Reports on the importance of the study of syndromes and their correlations with Western medicine to the advancement of integrative medicine (TCM and Western) and towards improved results	Describes the difficulty of examination because of the diversity of signs and symptoms of pulse and tongue
Yan Z et al, 2009 ³⁵ (not included)	1	Proposes a feature quantification framework for the inspection of sublingual veins	Requires equipment for TI
Sun DZ et al, 2010 ³⁶ (not included)	2	Describes signs and symptoms of patients with stomach cancer, relating them to the TCM syndromes and including TCs	Lists some TCs
Xiongnu G et al, 2011 ³⁷ (not included)	2	Uses signs and symptoms in patients with chronic low-back pain and includes TCs to establish correlations with TCM-based pathophysiological patterns	Enumerates TCs

*Categories: 1 = tongue inspection model; 2 = tongue characteristics; 3 = tongue characteristics and prognosis

information that is being provided by the schools. Furthermore, we believe it is important to study the terms in Portuguese and compare them with the international literature. For that reason, one of the books is an English translation of a Chinese book. We used the most recent editions available in Brazil. What follows is the wealth of information gleaned from the textbook review.

Tongue inspection

The review focused on eight items observed during tongue inspection. Three authors referred to lighting as an important factor to be noted in TI, but their descriptions differ¹²⁻¹⁴. The key is to find natural lighting (cited by all). However, Yamamura¹³ adds the possibility of using cold light, while Maciocia¹⁴ mentions incandescent light, full-spectrum fluorescent lighting, or tungsten lamps.

The extension of the tongue is also addressed by these authors, with the following specifications: it should be natural¹², relaxed^{12,13}, outstretched without excessive force¹⁴.

Maximum tongue exposure time is only mentioned by Maciocia¹⁴ whereas food consumption issues are cited by another author¹². All three authors mention food intake that changes the tongue color, e.g. dyes, while the possibility of cleaning the tongue is referred to by only one author¹². The use of medication can also alter the examination results, as mentioned by the three authors¹²⁻¹⁴.

Tongue characteristics

The characteristics of the tongue described as normal or abnormal are not clear. Moreover, tongue description involves subjective evaluations based on individual experience. In consonance with Kim⁶, who examined nine TCM texts and five TCM journals, we found inadequate, unclear, vague descriptions, or no tongue description at all.

Normal tongue characteristics

The normal TCs are listed in Table 2.

“Vitality” is only mentioned in one book on tongue inspection¹⁴.

Normal tongue coating is described as “white and thin” by Fei¹² and Maciocia¹⁴, while for Yamamura¹³ it should be “slightly moist and shiny, with homogeneous

Table 2. *Normal tongue characteristics and corresponding descriptions according to the textbook review*

Tongue characteristic	Fei¹²	Yamamura¹³	Maciocia¹⁴
Vitality	No citation	No citation	Vibrant and vital color, especially in the root
Coating	Thin, whitish	Thin, whitish, slightly damp and shiny, translucent, and homogeneous distribution	Thin, whitish
Color	Slightly red and fresh	Rosy and bright	Pale red and fresh
Moistness	Moist	Extremely thin film of saliva, giving the aspect of wet tongue	Slightly moist, not too dry, not too wet
Movement	Flexible and nimble	Good mobility	Flexible, neither too flaccid nor too rigid, no shakes or shudders when stretched, neither rigid nor involuntarily immobile
Gustation	Taste sense	No citation	No citation
Size	No citation	Proportional to the size of the mouth	Neither increased nor thin

distribution, and translucent”.

Fei¹² describes the normal color of the tongue body as “light red and fresh”. To Yamamura¹³, it is “rosy and bright”, and Maciocia¹⁴ describes it as “pale red and fresh”.

Moisture is described as “a thin film of saliva, resembling a wet tongue,” or as “slightly moist, not too dry or too wet,” or simply “wet”.

Movement was also described differently by those authors. Fei¹² defines it as “flexible and agile”, Yamamura¹³ refers to normal movement as “good mobility”, and Maciocia¹⁴ describes it as “flexible, not too flaccid and not too stiff, not trembles or shudders when stretched, not rigid or immobile involuntarily”.

Only Fei¹² addresses the issue of normality of taste on examination.

Yamamura¹³ describes normal size as “proportional to the size of the mouth” while Maciocia¹⁴ defines it as “not increased nor thin”.

Abnormal tongue characteristics

The three books describe TI under two major headings, body and coating, but the subheadings are different for all of them¹²⁻¹⁴.

Tongue coating

Coating had 70 citations, 53 of which were made solely once. Only five categories were cited by three authors (Table 3). These types of coating are 1) white and thin; 2) yellow; 3) mildewed white; 4) gray, and 5) black. The descriptions are rich in adjectives. “Mildewed white”, for example, is described as “snowflake-like or congee-like white spots”¹², “thick white granules of cheese”¹³, or “(moldy) thick and irregular in distribution, such as beancurd or crumbled cottage cheese, non-adherent”¹⁴, ambiguous or inaccurate descriptions that can be misleading. In general, the books divided coating into color and quality. Quality includes thickness, type, and moisture. Regarding coating color, there are no illustrations or color chart. The same occurs with the colors of the tongue body. The authors include major types, but they establish associations with other features that they consider important, which increases the number of coating subtypes without providing a clear description. This occurs, in general, with all TCs described in the three books.

Tongue body

It includes color, shape, size, thickness, mobility, moistness, length, deviated tongue, tooth marks, cracks, dots, spots, ulcers, and other uncommon categories.

We found 44 terms describing the color of the tongue body. Fei¹² cites seven types and describes five; Yamamura¹³, 22/4, and Maciocia¹⁴, 27/18. As with tongue coating, there are many associations of color with other features of the tongue. Basically, there are four tongue body colors: pink, red, purple/blue, and pale pink. Only two categories were cited by three authors: pale and red (Table 3).

Fifteen items are listed under “size”. Fei¹² cites seven and describes two; Yamamura¹³, 11/3, and Macio-

cia¹⁴, 7/5. Four items are cited by all authors, but with different descriptions. Four categories were cited by three authors: enlarged, enlarged and red, enlarged and pale, and thin (Table 3). There is no description of parameters to evaluate tongue size.

Under “movement”, 35 items are listed. Fei¹² cites only one and does not describe it. Yamamura¹³ cites 34 and describes 12; Maciocia¹⁴ mentions five, but does not describe any. We excluded 31 types of movement that were mentioned by a single author. Only one category was cited by three authors: deviated tongue (Table 3).

Regarding “shape and aspect”, 31 items were found, including cracks, tooth marks, spots, dots, stretching, consistence, ulcers, and some peculiar aspects such as cerebellar or hammer tongue. Fei¹² cites seven items and describes three; Yamamura¹³, 11/9; Maciocia¹⁴, 24/18. There were only three code 3 items: tooth marks, cracks, and ulcers. We excluded 23 types that were mentioned by a single author (Table 3).

Fifteen items were listed for “dots”. Fei¹² cites one, but offers no description. Yamamura¹³ cites 15 and describes 13, and Maciocia¹⁴ cites three, with one description. Only one item was common to all three texts; however, it was not described (Table 3). We excluded 12 types mentioned by only one author. Besides the color, the location of the dots on the tongue surface is another important aspect to the authors. Only one item was cited by three authors: red dots¹²⁻¹⁴.

“Spots” comprise six items. Neither Fei¹² nor Yamamura¹³ describe any. Maciocia¹⁴ cites six items, but describes only “spots” and “petechiae” (Table 3). No item was cited by three authors in this category¹²⁻¹⁴.

Disease prognosis

All the authors refer to evaluation of prognosis and disease course related to tongue coating and body color¹²⁻¹⁴. Normal coating is white and turns yellow with internal heat. It becomes thick if there is damp or phlegm. Coating turns yellow with the progression of internal heat, and orange, brown, or black in severe cases.

Color can also range from pink (normal) to red in cases of heat or yang, and deep red with worse conditions. Purplish hues appear with stasis by heat or cold, and pale in cases of yang or blood deficiency.

Table 3. Characteristics of tongue coating according to citation and agreement between books (authors Fei¹², Yamamura¹³, and Maciocia¹⁴).

		Fei ¹²	Yamamura ¹³	Maciocia ¹⁴	Agreement	Description
COATING	thin	0	+	+	Y	Y
	absent	+	+	0	Y	Y
	thick and greasy	+	+	0	N	Y
	white and thin	+	+	+	N	Y
	white, thin, shiny, and moist	+	+	0	N	Y
	white, thin, opaque, and dry	0	+	+	Y	Y
	white, thick, smooth, slimy, and sticky	0	+	+	Y	Y
	white, thick, dry, and dull	0	+	+	Y	Y
	white and mildewed	+	+	+	N	Y
	yellow	+	+	+	N	Y
	yellow, thick, and greasy	+	0	+	Y	Y
	yellow and dry/rough	+	0	+	N	Y
	gray	+	+	+	Y	N
	gray and dry	0	+	+	Y	Y
	black	+	+	+	Y	N
	multiple colors	0	+	+	N	Y
	dry	0	+	+	Y	Y
	COLOR	pale *	+	+	+	Y
red		+	+	+	Y	Y
crimson		+	+	+	Y	Y
dark red with a dry center		0	+	+	N	N
dark red with red dots		0	+	+	N	N
blue purple		+	0	+	Y	Y
pale purple		+	+	0	N	Y
dark red		+	+	0	Y	N
stasis maculae and stasis spot		+	+	0	Y	N
SIZE		enlarged	+	+	+	Y
	enlarged and red	+	+	+	N	N
	enlarged and pale	+	+	+	Y	N
	Thin	+	+	+	N	Y
	thin and red	+	+	0	Y	N
	thin and pale	+	+	0	Y	N
	Quivering	0	+	+	N	Y
MOVEMENT	Stiff	0	+	+	N	Y
	deviated*	+	+	+	Y	Y
	Rolled	0	+	+	Y	Y
SHAPE/ASPECT	tender	+	0	+	N	Y
	hammer-shaped	0	+	+	N	Y
	Cracked	+	+	+	N	Y
	horizontal crack	0	+	+	N	Y
	irregular crack	0	+	+	N	Y
	tongue ulcer	+	+	+	N	Y
	tooth mark	+	+	+	N	Y
	hairy or prickly tongue	0	+	+	Y	Y

*Cited and with author agreement; 0 = not cited; + = cited; Y= Yes; N = No

Two or more authors cited the listed items

We excluded 53 types of coating cited by a single author

We excluded 35 types of color mentioned by a single author

Table 3. *Continuation.*

		Fei ¹²	Yamamura ¹³	Maciocia ¹⁴	Agreement	Description
DOTS	red	+	+	+	Y	N
	bulging red	0	+	+	N	Y
	black	0	+	+	N	Y
SPOT	Spot	0	+	0	N	Y
	Red	0	+	0	N	Y
	Purple	0	+	0	N	Y
	Black	0	+	0	N	Y
	black spots in the center and white in other areas petechiae	0	+	0	N	Y

TCM journals

We found 82 articles correlating tongue, diagnosis, prognosis and TCM, most of them in Chinese. We selected 26 articles referring to “tongue inspection according to TCM”; however, none of those papers outlines a protocol. No article defines or describes the features of the tongue, although these pieces of information can be found in the textbooks on the subject. This can be seen in the articles analyzing the concepts of the TCs, which also referred to the books (Table 1).

Regarding TI, there is consensus in the literature about the subjectivity of the exam^{15,16}. In view of this, some papers describe developing techniques for image capture and computerized analysis of the tongue to attenuate subjectivity. One reason for this could be the methodology of TCM schools, which is based on an ancient tradition with a different model of teaching and learning. Another likely explanation is the reasoning process of tongue diagnosis in TCM. It seems to be a multifaceted and continuous process, with a systematic evaluation of the tongue and consistent diagnostic procedures¹⁶. However, the aim of the present study was to construct a protocol for practitioners and non-practitioners of TCM to identify disease severity regardless of symptoms, and determine prognosis. Therefore, items such as the map of organs on the surface of the tongue were not included, and the analysis was not related to TCM syndrome diagnoses.

We found seven papers on characteristics of the tongue; however, we located no description of the characteristics. Two studies focused on a healthy population

and the prevalence of normal and abnormal characteristics^{17,38}. The aim of several studies was to correlate the presence of abnormal TCs with some syndromes and diseases^{19,21,39}.

There are some studies about disease prognosis²². Color and coating are considered to be important prognostic features in cancer²², lung cancer¹⁹, and rheumatoid arthritis²³. Thickness is mentioned in one study¹⁹; this is an important component of TI, and we believe that it can be very useful in monitoring patients undergoing any type of therapeutic intervention. However, the evolution of TCs and the relationships between other features remain unclear. It could also identify patients at risk for sudden aggravation of their condition. In our outpatient clinic, we study neurological diseases with progressive neuromotor dysfunction.

In Eastern medicine, studies are advancing toward an objective assessment of the TCs, as several researchers have published their results with the use of images obtained from spectrometry or computerized analysis (Table 1). Unfortunately, this technology is not available in Brazil yet. Nevertheless, we understand that direct clinical examination is of great utility and can be easily performed after proper training. It is necessary to enhance communication in order to facilitate the dialogue between the two models of medicine - TCM and Western - by adapting the language and establishing concepts and standards for the items to be evaluated, including parameters of normality.

To perform good quality TI, some parameters have been established and are described as follows:

Systematic TI method

The standards comprise the following items:

1. **Examiner:** The analyses are to be performed by a single TCM-trained professional with expertise in tongue inspection or specific training.

2. **Environment:** Light-colored walls, preferably white, are recommended. Cold white or natural lighting should be aimed directly at the tongue.

3. **Positioning of the examinee:** The individual should be in a sitting position, relaxed, breathing softly and naturally, preferably in a lower position relative to the examiner and facing them.

4. **Staining substances:** The presence of staining substances on the examinee's tongue requires the tongue evaluation to be adjourned. Guidelines on solid food, drinks, and cigarettes must be included.

5. **Tongue scraping:** If tongue scraping was performed before the analysis, the exam should be repeated at a different time with the recommendation not to scrape the tongue prior to examination.

6. **Guidelines on tongue exposure:** Patients were instructed to "Please, show your tongue." If any clarification was needed, the individuals were asked to "Please, relax your tongue, and show it one more time," or "Please expose your tongue a little bit further." In those instances, although certain patients needed to exert significant strength to expose the tongue, they were advised not to contract the tongue extensively to avoid compromising blood flow.

7. **Time of tongue exposure:** The tongue should not be exposed outside of the oral cavity for periods longer than 10 seconds. If a new observation is necessary, the tongue should be withdrawn to allow relaxation, followed by new exposure. This approach will avoid long exposure times.

Tongue analysis systematization

Tongue analysis was systematized according to the items described in the literature, and organized using TCM theory and empirical expertise to create a scale of increasing complexity of physiological changes (vertical axis, *y*) and increasing severity of TCs (horizontal axis, *x*). Six variables were assigned to the vertical axis, and five degrees to the horizontal axis.

The horizontal axis includes information concerning degrees of severity and prognosis. The exact sequence in which the TCs appear and their temporal relationship is still unknown. In view of this, the *x* axis construction was based on the TCM theory of depths of disease, which describes levels, or layers, where the affection arises, from the most superficial to the deepest layer, with increasing depths meaning worsening disease status. These layers (from superficial to deep) are the following: Wei Qi, Qi, Yin, Xue, and collapse of Yin and Yang (Jing). Then completed, from left to right, with TCs corresponding to their respective level of impairment. The first degree is related to the normal aspect, with mild and superficial impairment (Wei Qi and Qi), followed by characteristics associated with a disturbance of Yin and Xue (Blood), which have moderate severity, and ending in the collapse of Yin and Yang, or Jing deficit (fifth degree), of marked severity or chronicity. Thus, each grade corresponds to a change in severity level.






Y-axis variables (vertical)

The core characteristics of the tongue were distributed in categories along the vertical axis. Most of these characteristics were cited in the three textbooks. Some features, such as movement and normal size, were included because of their great importance in neurology, according to the empirical experience of the authors. The description or definition of the terms for the present protocol was the result of the literature review combined with the empirical experience of the specialist team-professionals with background in TCM and clinical experience of more than 10 years (Figure 1). The characteristics were described below.

1. **Moisture:** Tongue moisture was considered normal when a thin coating of saliva was present without fully covering the papillae. The tongue should have a glossy appearance, and upon touching, one should feel the saliva and moisture but should also still be able to feel the roughness of the surface imparted by the papillae.

Certain patients affected by neuromuscular diseases can present excessive moisture, which cannot be attributed to excessive saliva, since, upon deglutition, the saliva coating remains thick, fully covering the papillae. In such cases, upon touching the tongue, one should ex-

Figure 1. *Tongue analysis systematization according to TCM.*

ASPECT	NORMAL	CHRONIC IMPAIRMENT		NEARLY IRREVERSIBLE IMPAIRMENT	
	1	2 MODERATE	3 INTENSE	4 MODERATE	5 INTENSE
MOISTNESS	normal ()	enhanced ()	decreased ()	dry ()	dry ()
COATING	thin, whitish ()	thick, whitish ()	thick, yellow ()	orange/green/black ()	no coating ()
COLOR	pink () 	red () 	purple () 	pale () 	whitish, pale () 
SIZE	normal ()	enlarged ()	enlarged ()	small/thin ()	atrophic ()
MOVEMENT	normal ()	deviated ()	tremulous ()	random movements ()	little exposure ()
OTHER FINDINGS	absent ()	red dots () tooth marks () cracks/ fissures ()	spots ()	fasciculation ()	fasciculation ()
● risk of sudden aggravation					

Normal moisture: A thin film of saliva covering the surface without fully covering the papillae.

The surface is glossy; upon touching, one should feel the presence of saliva (and moisture) and the roughness imparted by the papillae.

Normal size: The tongue does not extend beyond the dental arch limits by more than one-third of its size.

Normal movement: Ease of movement without straining the facial and cervical muscle groups. Centered, without abnormal movement, and remaining firm and relaxed without signs of stiffness or contraction.

pect to feel this moisture as well as the smooth, slippery surface of the tongue. The most chronic condition is associated with the absence of fluids and a dry tongue. This condition should give the impression of a lack of saliva and a dry feeling to the touch.

2. Coating: Thin coating, by definition, consists of a thin, whitish layer that allows the observation of the tongue surface and its papillae. Individual coating grains are not normally observed. Thick coating differs from thin coating by presenting itself as a single-layered coating on the papillae, as an agglomerate, or as an actual layer covering the surface of the tongue. It may be present on the entire surface or in localized regions. The coating can be clearly and unmistakably observed.

This coating can present a whitish, gray, or yellowish color with different levels of intensity, ranging from orange to green or dark shades. The perception of the color can depend on the cosmetics (e.g., lipstick) used by the patient, the color of the examination room, and the lighting. Therefore, environmental standardization is important. Coating may be absent at different stages of severity. In this case, the tongue presents itself to the naked eye as a smooth and shiny surface.

Tongue scraping can partially remove thin coating and, on occasion (albeit more difficult), certain

variants of thick coating. When a history of tongue scraping is discovered, the analysis should be repeated after advising the patient not to perform this action.

3. Color: Pink color, although classified as normal, may be difficult to characterize because it can vary from pale pink (the most serious condition) to different shades of red. The standard color pattern was determined based both on image reproductions of the tongue analysis atlas and on the examiners' clinical experience. The comparison of images containing pink or red colors allows for a clear distinction of shades. The shade classified as normal from the analysis of the photographic records obtained in the outpatient clinic is presented in Figure 1.

Color chart was obtained from tongue photographs (Figure 2). Color may vary in the different tongue topographies. In certain cases, several shades of color are present in the same tongue, with different implications, although the shade indicating the most serious condition is the one to be considered.

In such cases, however, all observed shades should be reported. The color purple was highlighted in the systematic analysis due to its implications (i.e., stasis), which can have a sudden and aggressive course and can be life-threatening. Even in lighter shades, the color purple can be readily identified.

4. Size: The size of the tongue was evaluated relative to the dental arch. Size can be classified as normal when the tongue does not extend beyond the dental arch by one-third of its size. If the exposed tongue surpasses that limit by more than one-third of its size, it can be considered an enlarged tongue. Similarly, small or thin tongues are defined as those smaller than the dental arch, with the tongue being classified as atrophic when the examiner can observe abundant free space within the boundaries of the dental arch, or when the tongue presents wrinkling associated with a loss of mass or shape.

5. Movement: Movement was standardized on the basis of normal tongue exposure. Normal movement is defined as easy, without straining the facial or cervical muscle groups, centered, without abnormal movement, with the tongue remaining relaxed and firm, with no stiffness or contractions. A deviated tongue is defined as any deviation of the exposed tongue from the midline. A tremor (quivering) is defined as any involuntary, intermittent movement with small amplitude that does not hinder speech or swallowing. Random movements are described as rare in the reviewed literature; they resemble amoeboid movements. They are involuntary and constant, and serve no specific function. Small exposures are characterized as ineffective tongue protruding movement despite the effort in performing that movement. If exposure does occur, it is only partial, at the expense of great muscular effort, and for a short period of time. Tongue tremors and deviations from the midline are also regarded as “red flags” and were highlighted in the systematic analysis. They can be related to energy fluctuations (internal wind), which may lead to acute cases of varying severity requiring medical intervention.

6. Other findings: Several different characteristics observed in abnormal tongues were pooled in this group. 1. Red dots result from increased blood flow toward the fungiform papillae, giving the tongue a darker shade of red. 2. Tooth marks are the persistent impression left by the dental arch on the edges of the tongue, which persist even after the tongue is relaxed and exposed outside of the oral cavity. 3. Fissures can present as cracks in the surface of the tongue in a transverse, horizontal, or diagonal orientation. The term “fissure” is exclusively used for cracks in the midline, regardless of their size. 4. Spots,

which were highlighted in the tongue systematic analysis, are defined as a circumscribed area where the color differs from the predominant shade on the tongue body. They can vary in size, shape, color, and location. They indicate stasis. 5. Fasciculation is defined as the involuntary and repetitive movement (twitching) of the resting tongue in the oral cavity.

X-axis variables (horizontal)

The construction of the protocol relied on the results gathered from the literature review, taking into account the items described most frequently by the three authors consulted. The items to be evaluated are listed in the rows. In each category, from left to right, the distribution follows the concept of depth of disease. It starts at “normal” followed by changes in the Qi 氣, Yang 陽, Yin 陰, Xue 血, and lastly Jing 精氣 deficiency. The order is also an attempt to organize the concepts, beginning with the normal patterns followed by excess, and finally, deficiency patterns. Three groups were formed: normal, chronic impairment, and chronic impairment difficult to reverse. The resulting model is shown in Figure 1. Tongue aspects and characteristics are shown in Figure 2.

CONCLUSION

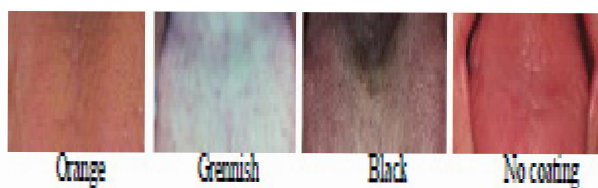
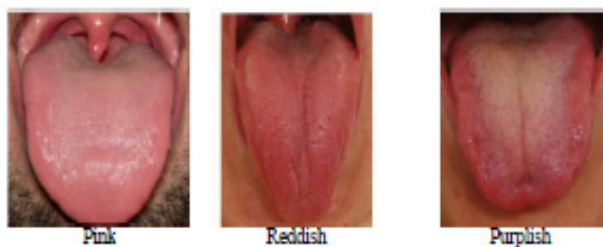
A systematic protocol of tongue inspection was prepared to be used in integrative medicine.

The systematization of clinical tongue evaluation is a necessity in research, and could be a useful instrument in the evaluation of health and disease states in a comprehensive and dynamic manner to highlight certain characteristics, differentiate between groups, and compare results.

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Figure 2. Tongue characteristics according to the systematized examination protocol.

1. MOISTNESS**2. COLOR****3. COATING****4. SIZE****5. MOVEMENT****6. OTHER FINDINGS**

Images from the archives of Traditional Chinese Medicine Clinic - Division of Neuromuscular Disease Research - Unifesp.

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