



The Correlation between Tongue Pain and Tenderness of Tongue by Digital Palpation in Burning Mouth Syndrome Patients: A Preliminary Study

Ji-Won Ryu, A-Hyang Yoon, Jong-Mo Ahn

Department of Oral Medicine, School of Dentistry, Chosun University, Gwangju, Korea

Received June 14, 2019

Revised June 17, 2019

Accepted June 17, 2019

Correspondence to:

Jong-Mo Ahn

Department of Oral Medicine, School of
Dentistry, Chosun University, 309 Pilmun-
daero, Dong-gu, Gwangju 61452, Korea
Tel: +82-62-220-3896

Fax: +82-62-234-2119

E-mail: jmahn@chosun.ac.kr

<https://orcid.org/0000-0002-3615-3688>

This study was supported by research fund
from Chosun University Dental Hospital,
2017.

Purpose: The aim of this study is to evaluate the correlation between tongue pain and tenderness of tongue by digital palpation (DP) in Burning Mouth Syndrome (BMS) patients.

Methods: One hundred thirty-four consecutive patients (60 BMS with tongue pain and 74 non-BMS) who attended the Department of Oral Medicine (Chosun University Dental Hospital, Gwangju, Korea) from January 2018 to December 2018 were included in this study. The examined sites were anterior, lateral (right and left) and central part of the tongue. The pain sites were reported by the patients and the tender points on DP test were recorded by the clinicians. DP test was performed by well-trained clinicians with palpation of the tongue with 0.5 kg pressure using the thumb and index finger. Obtained results for BMS and non-BMS group were compared using t-test ($p < 0.05$).

Results: 1. The BMS group had higher tender score on DP test of the tongue and there was a significant difference between the BMS and non-BMS groups. 2. The accuracy of the pain site and the tender point was shown to be 0.68 total (anterior 0.68; right lateral 0.69; left lateral 0.70; central 0.61).

Conclusions: This study suggests that the tenderness to DP of the tongue could be related to the painsites in the BMS patients. Further study is needed to confirm the usefulness of DP test of the tongue to examine the BMS patients.

Key Words: Burning mouth syndrome; Palpation; Tongue

INTRODUCTION

Burning mouth syndrome (BMS) is characterized by the presence of all forms of burning sensation in the mouth in the absence of local or systemic diseases or alterations [1,2]. The International Headache Society (IHS) proposed diagnostic criteria of BMS: (i) pain in the mouth present daily and persisting for most of the day, (ii) a persistent (more than 2 h/day) and burning quality of the pain, (iii) oral mucosa of normal appearance, and (iv) absence of local and systemic diseases [3]. The most affected area is the tongue (particularly the tip and lateral borders) [4], and other regions (lips, hard, and soft palates) may also be affected [5].

In clinics, patients who complain of oral burning pain without a clear cause in the mouth are common, and many researches related to BMS have been conducted in the academic community. However, the pathophysiology of BMS has not yet been clarified because of its heterogeneity [6]. It is presumed that various factors and psychological factors are acting in combination [7].

According to the IHS diagnostic criteria, a diagnosis of BMS can be made only if the oral mucosa has normal appearance and clinical examination including sensory testing reveals normal state [3].

However, there is no standardized procedure for the clinical examination of BMS, especially for the sensory testing

of the affected areas. Therefore, diagnosing BMS would be a challenge to clinicians.

Recently, the Quantitative Sensory Test (QST) has been applied in the study of BMS. QST is a method used to quantify sensory nerve function in patients with neurological impairment or disease, providing information about the function of the peripheral and central nervous system in response to a variety of stimuli [8]. However, in order to use QST in clinical practice, equipment is needed and there is a disadvantage that the interpretation varies depending on the stimuli used. In addition, several studies using QST in patients with BMS have yielded conflicting results [9].

The tongue has complex muscle architecture and is highly innervated [10]. There are at least 8,000 motor units in the tongue muscle [11]. A widely accepted method of determining muscle tenderness and pain is by digital palpation (DP) [12].

Therefore, the aim of this study is to evaluate the correlation between tongue pain and tenderness of tongue by DP in BMS patients.

MATERIALS AND METHODS

1. Study Design

This study was an age-matched preliminary study to evaluate the correlation between tongue pain and tenderness of tongue by DP in BMS patients who visited the Department of Oral Medicine of Chosun University Dental Hospital.

This study was approved by the Institutional Review Committee of the Dental Hospital of Chosun University (IRB no. 1609/044-R01). Informed consent in accordance with the Helsinki II declaration was obtained from all participants prior to inclusion.

2. Participants

Consecutive patients who attended the Department of Oral Medicine (Chosun University Dental Hospital, Gwangju, Korea) from January 2018 to December 2018 were included in this study. The inclusion criteria for BMS patients were according to the International Classification of Headache Disorders-3 classification (ICHD-3) suggested by IHS. In this study, BMS patients with tongue pain were

only included. The exclusion criteria for patients with BMS were candida infections by candida culture, vitamin B12 deficiency, folic acid deficiency, and diabetes by blood tests. The present pain intensity was rated on a numerical rating scale (NRS) from 0=no pain to 10=worst pain imaginable in the BMS patient group.

Non-BMS patient group inclusion criteria were those who did not have oral facial pain or oral mucosal disease.

3. Digital Palpation Test

Well-trained clinicians (AH and JW) performed the DP test by applying soft and solid pressure with 0.5 kg using the thumb and index finger. Prior to the beginning of the study, a training and calibration session was performed for the examiners to ensure mutual agreement, and to accurately interpret the measurements used in the study.

DP test was performed at the following four sites for all participants: anterior, lateral (right and left) and central part of tongue.

The pain sites were reported by the patients and the tender points on DP test were recorded by the clinicians. Tenderness to palpation was scored on a 4-point ordinal scale: 0 (no pain), 1 (mild), 2 (moderate), and 3 (severe) [13]. To assess whether the pain area of the tongue in the BMS patients matched the area of the pain palpated, sensitivity and specificity, and accuracy were calculated.

4. Statistical Analysis

In the BMS and non-BMS patients, the tender score at the DP was recorded and the mean value of the entire tongue was calculated.

Obtained results for the BMS and non-BMS group were compared using t-test.

Statistical analyses were performed using PASW Statistics for Windows, Version 18.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was considered as $p < 0.05$.

RESULTS

A total of 134 patients were included in the study. There were 60 patients with BMS and 74 patients in the non-BMS group. The clinical characteristics of the participants are shown in Table 1.

All BMS patients reported a burning sensation on the tongue. Most of them (47, 78.3%) reported burning only at this site. The other 13 patients (21.7%) reported that the burning sensation occurred concomitantly in other parts of the oral cavity, including the gingiva, palate and lips. Mean NRS pain score in the BMS group was 5.4 ± 2.4 .

1. Relationship of Presence of Tongue Pain in Digital Palpation Each Group

The mean tender score of the tongue was 3.2 ± 2.3 in the BMS group and 1.3 ± 2.3 in the non-BMS group. BMS group had a statistically significant higher value of tender score than non-BMS group in t-test (Table 2).

2. Sensitivity, Specificity, Odds Ratio, and Accuracy for Digital Palpation Test

Table 3 showed estimates for sensitivity, specificity, odds ratio for pain sites of DP test. The accuracy was shown to be 0.68 total (anterior 0.68; right lateral 0.69; left lateral 0.70; central 0.61).

DISCUSSION

The International Association for the Study of Pain (IASP)

presents BMS as “a chronic condition characterized by a burning sensation of the oral mucosa for which no cause can be found” [1,14].

BMS usually occurs in middle-aged and elderly patients more often than in children and adolescents, and female predominance has been reported [15]. In the present study, the mean age (65.3 years) and sex ratio (male:female;1:8) of the patients diagnosed with BMS were similar to those of the previous studies [16].

Current literature points toward a neuropathic origin for BMS, involving both the peripheral and central nervous systems [17]. Because of its complexity of pathophysiology, the diagnosis of BMS remains challenging. Therefore, clinicians usually do differential diagnosis to rule out other possible related conditions, so the final diagnose depends mainly on the patients' subjective symptoms and history, instead of using the classification-based criteria of ICHD or IASP [15]. Most of the complaints of BMS patients are focused on their tongue, usually a tingling/burning/numbing sensation or feeling [18]. For that reason, we have tried to investigate on the tongue whether there might be any changes attributed to the symptom of BMS.

Up to now, enormous studies have been conducted to explore the relationships between tongue and swallowing disorders. Tongue muscles have high levels of capillarization and hybrid fibers [10]. In the animal study, age was

Table 1. Demographic characteristics of the patients

Characteristic	BMS (n=60)	Non-BMS (n=74)
Sex		
Male	7 (11.7)	25 (33.8)
Female	53 (88.3)	49 (66.2)
Age		
Male	56.1 ± 10.0	61.6 ± 12.4
Female	66.4 ± 10.0	67.9 ± 11.2
Total	65.3 ± 10.5	65.0 ± 11.9

BMS, burning mouth syndrome.

Values are presented as number (%) or mean \pm standard deviation.

Table 2. Comparisons of mean values of tenderness scores between groups

Group	Mean of total sites	Mean of each sites
BMS	$3.2 \pm 2.3^*$	$0.8 \pm 0.6^*$
Non-BMS	1.3 ± 2.3	0.3 ± 0.6

BMS, burning mouth syndrome.

Values are presented as mean \pm standard deviation.

* $p < 0.05$.

Table 3. Sensitivity, specificity, OR, and accuracy of digital palpation of the tongue

Sites	Sensitivity	Specificity	OR	Accuracy
Anterior	0.74	0.54	3.34	0.70
Right lateral	0.69	0.66	4.32	0.69
Left lateral	0.75	0.38	1.80	0.70
Middle	0.60	0.61	2.35	0.61
Total	0.70	0.57	3.09	0.68

OR, odds ratio.

Values are presented as number only.

associated with increased percentages of more slowly contracting muscle fiber types and reductions in fiber size that were region and muscle specific, and this was in accordance with the study in human cadaveric intrinsic tongue muscles [19]. Specifically, muscle fiber diameter increased with distance from the tip of the tongue, more rapidly-contracting muscle fibers were found in the anterior tongue, and a greater percentage of slower fibers in the posterior tongue. Interestingly, a trend of decreasing superior longitudinal muscle fiber diameter with age is in opposition to a report of increasing muscle fiber cross-sectional area near the lingual root after age 44 [20]. Oral motor function such as jaw and tongue movement is decreased with aging [21]. According to a study on aging and masticatory function, age was significantly related to the speed of tongue movement in men and the tongue muscle force in women [22].

Therefore, when performing a study on BMS, anatomical and functional changes of the tongue should be considered. However, there is no paper that evaluates the relationship between tongue muscles and BMS. In this study, we performed a DP test to evaluate the function of the tongue. DP testing is one of the most common clinical methods to assess muscle strength and dysfunction. Generally, a healthy muscle does not elicit sensations of tenderness of pain when palpated [12]. Palpation by an experienced clinician may be a sufficiently reliable method for screening painful areas, and therefore may be able to reveal the site of the pain [23,24]. The recommended pressure when palpating head and neck muscle is between 0.5 and 4 kg/cm² [25]. Diagnostic criteria for Temporomandibular Disorders recommended 0.5 kg on palpating supplemental muscles [26]. In this study, the BMS group had a statistically significant higher value of tender score than the non-BMS group. Additionally, we investigated whether the site of pain complaint and the site of tenderness during DP test were matched. The accuracy of the DP test was 0.68. This result suggests that DP test can reproduce the tongue pain of the patient to some extent. Therefore, the tenderness to DP of tongue could be related to the pain-sites in the BMS patients. However, the results of this study were only a comparison of the patients' symptoms with the results of the clinical examination. Further studies on this result should be made in the future.

There were limitations of the study. The age of the BMS and non-BMS group were matched, but the male to female sex ratio was somewhat higher in the non-BMS group than in the BMS group.

In addition, BMS patients with tongue pain were only included in the study. In the future, we should expand the study population to BMS patients without tongue pain or BMS patients with tongue and other oral mucosal pain, and investigate the association between BMS symptoms and tenderness of tongue with DP test.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ORCID

Ji-Won Ryu

<https://orcid.org/0000-0002-5586-8195>

A-Hyang Yoon

<https://orcid.org/0000-0002-4588-0692>

Jong-Mo Ahn

<https://orcid.org/0000-0002-3615-3688>

REFERENCES

1. IASP. Orofacial pain fact sheet. Burning mouth syndrome [Internet]. IASP; c2016. [cited 2019 May 16]. Available from: https://www.iasp-pain.org/files/Content/ContentFolders/GlobalYearAgainstPain2/20132014OrofacialPain/FactSheets/Burning_Mouth_Syndrome_2016.pdf.
2. Feller L, Fourie J, Bouckaert M, Khammissa RAG, Ballyram R, Lemmer J. Burning mouth syndrome: aetiopathogenesis and principles of management. *Pain Res Manag* 2017. doi: 10.1155/2017/1926269.
3. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition. *Cephalalgia* 2018;38:178.
4. Tiwar A, Dhawan R. Burning mouth syndrome: a comprehensive analysis from different perspectives. *Int J Sci Res* 2015;4:2116-2120.
5. Grushka M, Ching V, Epstein J. Burning mouth syndrome. *Adv Otorhinolaryngol* 2006;63:278-287.
6. Coculescu EC, Tovar S, Coculescu BI. Epidemiological and etiological aspects of burning mouth syndrome. *J Med Life* 2014;7:305-309.
7. Al Quran FA. Psychological profile in burning mouth syndrome.

- Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004;97:339-344.
8. Eliav E, Gracely RH, Nahlieli O, Benoliel R. Quantitative sensory testing in trigeminal nerve damage assessment. *J Orofac Pain* 2004;18:339-344.
 9. Kaplan I, Levin T, Papoiu AD, et al. Thermal sensory and pain thresholds in the tongue and chin change with age, but are not altered in burning mouth syndrome. *Skin Res Technol* 2011;17:196-200.
 10. Stone M, Woo J, Lee J, et al. Structure and variability in human tongue muscle anatomy. *Comput Methods Biomech Biomed Eng Imaging Vis* 2018;6:499-507.
 11. O'Kusky JR, Norman MG. Sudden infant death syndrome: increased number of synapses in the hypoglossal nucleus. *J Neuro-pathol Exp Neurol* 1995;54:6276-6734.
 12. Okeson JP. Management of temporomandibular disorders and occlusion. 7th ed. St. Louis: Elsevier Mosby; 2013. pp. 187-245.
 13. Almoznino G, Zini A, Zakuto A, et al. Muscle tenderness score in temporomandibular disorders patients: a case-control study. *J Oral Rehabil* 2019;46:209-218.
 14. Merskey H, Bogduk N. Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms. 2nd ed. Seattle, WA: IASP Press; 1994. pp. 74.
 15. Tu TTH, Takenoshita M, Matsuoka H, et al. Current management strategies for the pain of elderly patients with burning mouth syndrome: a critical review. *Biopsychosoc Med* 2019. doi: 10.1186/s13030-019-0142-7.
 16. Savage NW. Burning mouth syndrome: patient management. *Aust Dent J* 1996;41:363-366.
 17. Moura BS, Ferreira NDR, DosSantos MF, Janini MER. Changes in the vibration sensitivity and pressure pain thresholds in patients with burning mouth syndrome. *PLoS One* 2018. doi: 10.1371/journal.pone.0197834.
 18. Jääskeläinen SK. Clinical neurophysiology and quantitative sensory testing in the investigation of orofacial pain and sensory function. *J Orofac Pain* 2004;18:85-107.
 19. Cullins MJ, Connor NP. Alterations of intrinsic tongue muscle properties with aging. *Muscle Nerve* 2017;56:E119-E125.
 20. Rother P, Wohlgemuth B, Wolff W, Rebstrost I. Morphometrically observable aging changes in the human tongue. *Ann Anat* 2002;184:159-164.
 21. Hiramatsu T, Kataoka H, Osaki M, Hagino H. Effect of aging on oral and swallowing function after meal consumption. *Clin Interv Aging* 2015;10:229-235.
 22. Sagawa K, Furuya H, Ohara Y, et al. Tongue function is important for masticatory performance in the healthy elderly: a cross-sectional survey of community-dwelling elderly. *J Prosthodont Res* 2019;63:31-34.
 23. Im YG, Kim BG. Management of lateral pterygoid myalgia with diagnostic local anesthetic injection: a report of 2 cases. *J Oral Med Pain* 2010;35:275-281.
 24. Jacobs JW, Geenen R, van der Heide A, Rasker JJ, Bijlsma JW. Are tender point scores assessed by manual palpation in fibromyalgia reliable? An investigation into the variance of tender point scores. *Scand J Rheumatol* 1995;24:243-247.
 25. de Leeuw R, Klasser GD. Orofacial pain: guidelines for assessment, diagnosis, and management, sixth edition. Hanover park, IL: Quintessence; 2018. pp. 26-49.
 26. Ohrbach R, Gonzalez YM, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): clinical examination protocol [Internet]. International RDC/TMD Consortium Network. [cited 2019 May 16]. Available from: https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/DC-TMD-English-Assessment-Instruments_2016_06_11_secured.pdf.