Journal of Acupuncture and Meridian Studies 2023;16(2):56-64
pISSN 2005-2901 • eISSN 2093-8152
https://doi.org/10.51507/j.jams.2023.16.2.56
RESEARCH ARTICLE

Abdominal Acupuncture for Non-Responding TMD Patients: a Retrospective Observational Study in General Practice

Emanuela Serritella*, Gabriella Galluccio, Carlo Di Paolo

Department of Oral and Maxillofacial Sciences, "Sapienza" University of Rome, Rome, Italy

Received November 10, 2022
Revised February 9, 2023
Accepted March 30, 2023

Correspondence to
Emanuela Serritella
Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, Rome, Italy
E-mail emanuela.serritella@uniroma1.it

Background: Pain related to Temporomandibular Disorders (TMD) is severe, negatively affecting patients' quality of life, and often resistant to conventional treatments. Abdominal Acupuncture (AA) is known to be particularly effective for pain, especially chronic and musculoskeletal pain, but it is still poorly studied and never investigated in TMD patients.
Objectives: To analyze the efficacy of AA for the treatment of patients with subacute and chronic pain related to TMD and non-responding to previous conventional therapies (occlusal splint, medications, physical therapy).
Methods: Twenty-eight patients, 24 F and four M (mean age 49.36 years), were recruited from January 2019-February 2021. All patients underwent AA treatment: two sessions per week for four weeks, for a total of eight sessions. At the beginning of therapy (T0) and at the end of the cycle (T1) the following data were evaluated: maximum mouth opening (MMO); cranio-facial pain related to TMD (verbal numeric scale, VNS); pain interference with normal activities and quality of life of patients (Brief Pain Inventory, BPI); oral functioning (Oral Behavior Checklist, OBC); impression of treatment effectiveness (Patients' Global Impression of Improvement, PGI-I Scale). Statistical comparison of data before and after the AA treatment was performed by Wilcoxon's signed-rank test (significance level $p < 0.05$).
Results: The MMO values were significantly improved after one cycle of AA ($p = 0.0002$). In addition, TMD-related pain had a statistically significant decline following AA treatment (all $p < 0.001$). Patients' general activity and quality of life (BPI) were described as improved following a course of AA, with statistically significant values for all aspects considered (all $p < 0.05$).
Conclusion: Abdominal acupuncture resulted in effective treatment of subacute/chronic-resistant pain related to TMD, capable of improving mandibular function and facial pain, and reduced the interference of pain affecting patients' quality of life.

Keywords: Temporomandibular disorders, Orofacial pain, Acupuncture, Abdominal acupuncture

INTRODUCTION

Temporomandibular disorders (TMD) refer to a group of conditions affecting the masticatory muscles, temporomandibular joint (TMJ), and associated surrounding structures such as connective tissues and ligaments [1]. These pathologies are characterized by a complex symptomatology consisting mainly of joint noises, joint and/or muscle pain, and impaired or limited mandibular movements [1-3]. TMD cause great suffering in patients and are a widespread problem in clinical practice, representing the most common orofacial pain (OP) diagnosis [3-5]. Patients with TMD have painful symptoms associated with the purely articular or muscular type, such as headache and neck pain. As with many other types of chronic pain, TMD-related pain, and especially myalgia/myofascial pain, often limits the daily life activities of patients [2,4,6,7]. TMD-related pain is described as one of the most common forms of musculoskeletal pain [8]. Subjects with chronic pain conditions experience other comorbid chronic pain conditions; painful TMD has been frequently associated with widespread pain [9]. In fact, patients with painful TMD seem to be more sensitive to experimental pain stimuli and have a lower pain tolerance than non-TMD subjects [10-12].

Acupuncture therapy (AT) is an effective method of pain management, especially for pain of musculoskeletal origin, including TMD [13,14]. Several clinical studies analyzed the effects of different types of acupuncture treatments on pain related to TMD and proven its effectiveness, especially for pain of muscular origin, such as myalgia and myofascial pain [15-17]. In the OP field, classic somatic AT is the most investigated AT method, followed by laser acupuncture, electroacupuncture and several microsystems AT methods, such as ear, scalp, mouth, and fingers [16-19].

Abdominal acupuncture (AA) is a relatively new microsystem technique, which was developed in the last 30 years by Prof. Bo Zhi-Yun [20]. Bo's Abdominal Meridian System (AMS) resulted from the combination of traditional Chinese meridian theory and his innovation in considering the acupoint Shenque (CV8), which corresponds to the navel, as the "mother-point" for regulating the distribution of *qi* and blood to the whole body, given its characteristics during intrauterine life [20-22]. According to AA theory, needles inserted at different depths at specific acupoints in the abdominal wall stimulates AMS, and thus be used to rebalance disharmonies and treat disease at any level of the human body [20]. Due to its clinical efficacy in treating chronic and long-term conditions such as neurological disorders, low-back pain, musculoskeletal disorders, depression and digestive conditions, this method became very popular among acupuncture practitioners both in China and Western countries. Currently, it is effectively used in the treatment of various disorders and different studies conveyed its efficacy, especially for pain and neurological disorders [21-22]. However, there is no evidence regarding the effectiveness of AA on OP and TMD-related pain and symptoms.

Given the well-known clinical effectiveness on chronic and resistant pain conditions, we applied AA at our University outpatient acupuncture clinic, as elective AT treatment for our patients with TMD affected by cranio-cervico-facial pain that does not respond to conventional OP treatment. The study presented below was performed retrospectively, to investigate and verify the effects of AA on pain and its interference with common activities and quality of life of patients with TMD, through the analysis of medical records and questionnaires that are routinely used in our specialistic ward.

MATERIALS AND METHODS

This study was a retrospective observational study in general practice. Patients referred to our acupuncture clinic in a University Hospital specialistic Unit of Orofacial Pain, between January 2019 to February 2021, were included. Forty-three patients were assessed and enrolled for AA treatment. Due to the COVID-19 pandemic during the period March-November 2020 (10 patients), or the distance to the hospital or job difficulties (2 patients), a total of 12 patients were excluded from the analysis for not finishing the full AT treatment; three patients were excluded for not completing the provided questionnaires. In total, 28 patients with subacute and chronic TMD-related pain non-responding to conventional treatments were fully treated and data analyzed. All patients were diagnosed with TMD pain (ICD-9 729.1; ICD-9 524.62; ICD-9 339.89; ICD-9 524.63) greater than or equal to 30 on the Numeric Verbal Scale (NVS), according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) classification [1]; the frequency of pain was greater than or equal to 1 time/week. All patients had an history of previous unsuccessful treatments such as advice or counseling regarding oral functioning, administration or topical use of pain medication, physical therapy, and/or an occlusal appliance.

As standard practice in our ward, all patients signed an informed consent form before undergoing acupuncture therapy, concerning both the treatment and the possible anonymous use of their clinical data for scientific and publication purposes. Participants also filled in validated questionnaires regarding their oral and general health conditions, before and after the AA treatment. The study was retrospectively approved by the Institutional Ethics Committee (N.112/22/0000868) and followed STROBE guidelines [23].

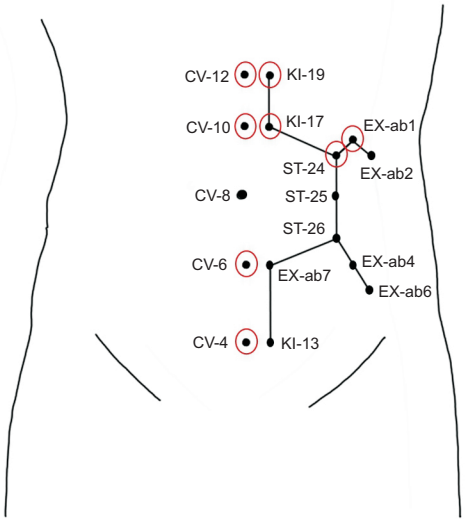

Fig. 1. Bo's abdominal acupuncture scheme: the lines in the left hemiabdomen show the "abdominal turtle pattern" according to Bo [20]. The selected acupoint are circled in red: CV-12 (4 cun above the navel); CV-10 (2 cun above the navel); CV-6 (1.5 cun below the navel); CV-4 (3 cun below the navel CV-8); KI-19 (0.5 cun lateral CV-12); KI-17 (0.5 cun lateral CV-10); ST-24 (2 cun lateral CV-9, located 1 cun above the navel); Ex-ab1 (0.5 cun lateral and 0.5 cun above ST-24).

1. Abdominal acupuncture treatment

The patients were treated two times per week for four weeks with abdominal acupuncture (AA) by an experienced physician and acupuncture licensed specialist (ES). The acupuncture points used were according to the Bo's Method of Abdominal Acupuncture [20-22]: CV 12 (Zhongwan), CV10 (Xiawan), CV6 (Qihai), CV4 (Guanyuan), ST24 (Huaroumen) bilaterally, EX - Ab1 (Shangfengshi) bilaterally, KI17 (Shangqu) and KI19 (Yindu) mono or bilaterally, according to pain location (Fig. 1).

Needles were inserted at the penetration site after asepsis of the skin with 70% alcohol. The needles were disposable and sterilized, individually packed, size 0.22 × 40 mm (TEWA, ASIA-MED GMBH & CO. KG). According to Bo's acupuncture method, the depth of needle penetration was "standard depth" for all selected points, except for KI19 ("superficial depth") [20]. The needles were not manipulated, and they remained in place for 30 minutes and were then removed.

2. Outcome measures and data analysis

Temporomandibular joint (TMJ) pain, masticatory muscle pain, headache, and neck pain were the symptoms assessed, and each one was measured through the 0-100 VNS. The maximum mouth opening (MMO) was measured in all patients, recording the interincisal distance in mm using a ruler (mouth opening without assistance).

All patients were requested to complete the following questionnaires. The Oral Behavior Checklist (OBC) estimated oral functioning. The questionnaire consisted of 21 items rated on a five-point Likert scale (0-4) asking about the frequency of parafunctional behaviors within the last month [1]. The Short Form of the Brief Inventory Pain (BPI) assessed the severity of pain and its impact on daily function, and was

Table 1. Patients' demographic and clinical baseline characteristics

No.	Gender	Age	Diagnosis			Side	MMO[b] (mm)	Pain duration (month)	Systemic disease	Past treatment
			Arthralgia	Myalgia	DDWR[a]					
1	F	49			×	B	39	5		PT, ST
2	F	65	×			R	39	4		ST
3	F	52	×	×	×	B	36	144	FM, UCTD	D, PT, ST
4	F	46	×	×		L	42	18		D, PT, ST
5	F	54	×		×	B	41	84	FM	D, PT, ST
6	F	49		×		B	40	60	FM, PsA	D, PT, ST
7	F	57		×		B	42	120	FM, UCTD	D, PT, ST
8	F	44	×			B	44	24		D, PT, ST
9	F	63	×			R	39	48	OP	D, ST
10	F	73	×	×	×	L	40	18	RA	D, PT, ST
11	F	61	×			B	41	6	OP	D, ST
12	F	45		×		R	42	18		PT, ST
13	F	27		×		B	34	42		D, PT, ST
14	M	28		×		B	43	12		PT, ST
15	F	48		×		B	40	4		D, ST
16	M	53	×			B	43	36		D, PT, ST
17	F	56	×	×		L	38	96	FM	D, PT, ST
18	F	37		×		B	37	24		PT, ST
19	F	62	×	×		B	49	84	RA	D, PT, ST
20	M	55	×			B	43	30		D, PT, ST
21	F	48	×	×	×	R	35	60		D, PT, ST
22	F	61		×		B	38	120		D, PT, ST
23	M	32		×		B	39	7		PT, ST
24	F	18		×		B	38	24		ST
25	F	45	×		×	L	36	18		D, PT, ST
26	F	60		×		B	42	144	FM	D, ST
27	F	52	×			L	40	60		D, PT, ST
28	F	42	×		×	B	42	4		ST

[a]DDWR = disc displacement with reduction; [b]MMO = maximum mouth opening.
D = drugs; FM = fibromyalgia; OP = osteoporosis; PsA = psoriatic arthritis; PT = physical therapy; RA = rheumatoid arthritis; differentiated Connective Tissue Disease.

comprised of nine items rated on a 0-10 Visual Numeric Scale (VNS) asking the patient to rate the severity of pain and of pain-related disability in the last 24 hours [24]. The Patients' Global Impression of Improvement (PGI-I) Scale is a global index indicating the response of a condition to a therapy; it evaluated patients' impression of treatment effectiveness [1].

Craniofacial pain intensity (NVS), pain and pain-related disability (BPI) and MMO were measured at the following times:

- T0: Baseline, before AA treatment
- T1: End of AA treatment, four weeks after T0 (after the last acupuncture session)

At T1, also the patient's impression of treatment effectiveness (PGI-I) was determined.

The statistical processing software SPSS (version 23) was used for data analysis. Normality of data distributions was examined using the Shapiro-Wilk test. The Wilcoxon signed-rank test was used to compare the VNS, MMO, OBC and BPI results before treatment (T0) with those obtained after AA (T1). For all tests, the level of significance was set at $p < 0.05$.

RESULTS

A total of 28 patients, 24 females (85.7%) and four males (14.3%), with an average age of 49.36 years, were fully treated

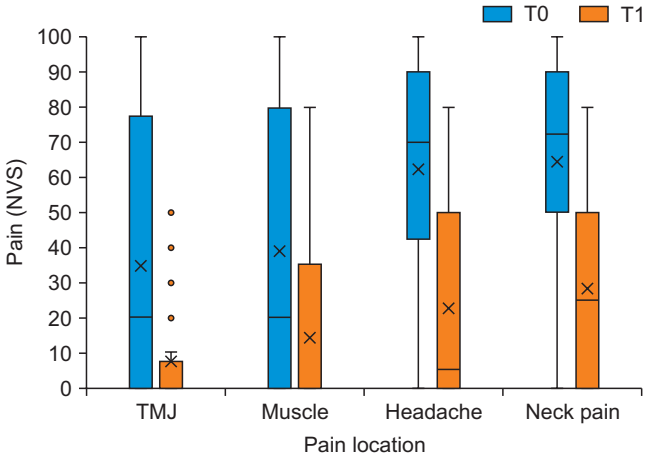

Fig. 2. Patients TMD-related pain distribution at T0 and T1, according to different locations: TMJ, Masticatory muscle, Head and Neck. Higher NVS scores indicate more severe pain. The horizontal bar inside the boxes indicates the median, the x inside the boxes indicates the mean, and the lower and upper ends of the boxes are the first and third quartiles. The whiskers indicate the minimum and the maximum ranges, and data more extreme than the whiskers are plotted individually as outliers (circles).

Table 2. Effect of abdominal acupuncture in the study population on: mouth opening (MMO), oral functioning (OBC), TMD-related pain (VNS), general pain and pain interference (BPI)

Variable	Before treatment–T0	After treatment–T1	Z	*p*-value
MMO	40.07 ± 3.13	41.82 ± 2.52	–3.724	0.0002
OBC	45.43 ±13.85	37.68 ±13.99	–3.959	< 0.0001
Pain (VNS)				
TMJ pain	34.64 ± 39.11	7.50 ± 15.54	–3.408	0.0006
Muscle pain	37.5 ± 4.88	14.28 ± 23.32	–3.296	0.0009
Headache	62.14 ± 33.81	22.50 ± 27.16	–4.197	< 0.0001
Neck pain	64.46 ± 35.68	28.21 ± 26.39	–4.197	< 0.0001
Brief pain inventory (BPI)				
Pain (VAS)				
1	6.43 ± 2.20	3.46 ± 2.22	–4.372	< 0.0001
2	3.21 ± 2.29	1.11 ± 1.42	–3.602	0.0003
3	5.21 ± 1.83	2.32 ± 1.87	–4.493	< 0.0001
4	4.78 ± 2.68	1.36 ± 1.61	–4.2378	< 0.0001
Pain interference (VAS)				
General activity	4.03 ± 2.38	1.89 ± 2.02	–4.107	< 0.0001
Mood	5.68 ± 2.88	2.68 ± 2.11	–4.197	< 0.0001
Walking ability	1.89 ± 2.79	0.89 ± 1.69	–2.665	0.0084
Normal work	3.64 ± 2.69	1.61 ± 1.90	–3.919	0.0001
Relations with other people	3.11 ± 2.30	1.93 ± 2.29	–3.296	0.0009
Sleep	4.71 ± 2.76	3.00 ± 2.71	–3.621	0.0003
Enjoyment of life	3.28 ± 2.55	1.82 ± 1.90	–3.621	0.0003

1 = WORST pain in the last 24 h; 2 = MINIMUM pain in the last 24 h; 3 = AVERAGE pain in the last 24 h; 4 = pain value in this moment.
Z, *p*-value: Wilcoxon signed-rank test results.

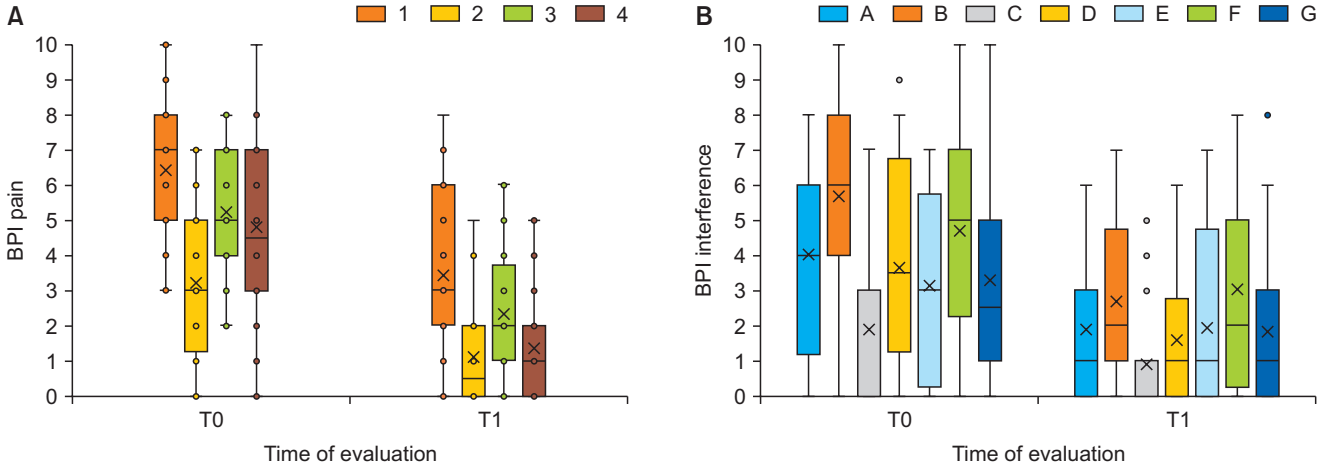

Fig. 3. Distribution at T0 and T1, according to BPI, of (A) TMD-related pain and (B) pain interference in common activities and quality of life. (A) 1 = WORST pain in the last 24 h; 2 = MINIMUM pain in the last 24 h; 3 = AVERAGE pain in the last 24 h; 4 = pain value IN THIS MOMENT. (B) A = General activity; B = Mood; C = Walking ability; D = Normal work; E = Relations with other people; F = Sleep; G = Enjoyment of life. Higher BPI scores indicate more severe pain (A) and more severe pain interference in quality of life's aspects (B). The horizontal bar inside the boxes indicates the median, the x inside the boxes indicates the mean, and the lower and upper ends of the boxes are the first and third quartiles. The whiskers indicate the minimum and the maximum ranges, and single data or data more extreme than the whiskers (outliers) are plotted individually as circles.

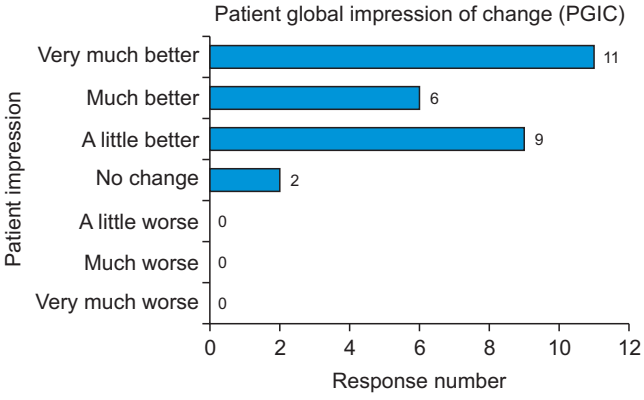

Fig. 4. Patients' impression of the treatment effectiveness at T1, according to the PGI-I Scale.

and analyzed. Nineteen (19) patients had bilateral TMD, and nine had unilateral TMD. From the onset of pathology, the range in the duration of symptoms was 4-144 months. Symptoms lasted for ≤ 6 months (subacute TMD) in five patients, and for > 6 months (chronic TMD) in the remaining 23 patients. Ten (10) patients were affected by a systemic painful condition (Table 1). No side effects or complications were observed with respect to the AA procedure itself and all patients tolerated the treatment well.

The application of AA resulted in a general improvement in MMO, oral functioning, patients' pain perception and pain interference with normal activities and quality of life (Table 2, Fig. 2, 3). The difference in MMO and the improvement in oral functioning (OBC) and pain perception, according to both NVS and BPI, at T0 and T1, resulted in statistical significance for all the considered variables (all $p < 0.05$), except for the variable "walking ability" ($p = 0.0084$) (Table 2).

Table 1 displays the participants' baseline demographic and clinical characteristics. Table 2 illustrates the exact results from data analysis. Fig. 2, 3 indicate the distribution of patients' pain and interference of pain perceptions, at T0 and T1, according to NVS (Fig. 2) and BPI (Fig. 3) scales. Fig. 4 presents the results of patients' self-evaluations of treatment effectiveness using the PGI-I scale.

DISCUSSION

According to Traditional Chinese Medicine (TCM), the abdomen is categorized as a type of acupuncture micro-system, i.e., a well-defined anatomical area in which all the structural and functional components of the human organism are represented, a miniature projection of the human body and its functions. The microsystems are somatotopic areas, in which each specific point represents a well-defined point of correspondence in the human body [25]. However, compared with other microsystems, such as the auricle, the scalp, the foot, or the hand, the abdomen is considered unique in its location. For TCM theory, the abdominal area (located behind the acupoints Qihai (CV6) and Guanyuan (CV4)) is the source of the human body's qi (vital energy) and jing (essence) resides [20-22,26]. In addition to the traditional meridian system, Dr. Bo Zhi-Yun discovered two other regulatory systems at different layers of the

abdomen wall [20,26]. These systems develop from the fetal circulatory system, which delivers blood and nutrients to the fetus via the umbilical cord, and which serves as a regulatory system of the human body during uterine life. Immediately after birth, fetal circulation undergoes a rapid transition to accommodate extra-uterine life [27]. However, the umbilicus has many embryological remnants, and these elements of the prenatal system and its ability to distribute qi and blood still exist in adults, and are centred at the navel, where the acupuncture point Shenque (CV8) is located [28]. Therefore, the abdominal region is an extremely valuable energetic area in acupuncture practice, center and origin of all the body's dynamic forces and functional activities, through which it is possible to treat all parts of the body. Thanks to these unique characteristics, Bo's method of abdominal acupuncture has been widely applied by acupuncture practitioners since its systematization in 1991, and has rapidly spread throughout the world. The few studies investigating the clinical effects of AA in the current scientific literature support the efficacy of this method and have led to results of general improvement of pain symptoms, including musculoskeletal disorders [29-33]. This evidence is in line with the results obtained in the present study, which reports for the first time, the application of AA for treating TMD-related pain and symptoms.

In addition, in modern scientific science, the abdomen represents a crucial part of the human body. This anatomical area has been intensely investigated in the scientific literature, and it is referred to as a "second brain"– the "abdominal brain" [34,35]. The relationship between the enteric nervous system (ENS), gut microbiota and neurological diseases, including chronic pain, is receiving increasing attention from researchers. The enteric nervous system shares many sensory and motor neurons, information processing circuits, neurotransmitters, receptors, and transcription factors with the central nervous system (CNS) [36]. Different studies on gastrointestinal behavior revealed a highly complex interaction among the microbiota, the bowels, and the brain through the so-called "gut-brain axis", a bidirectional neurohumoral connection system regulated by spinal and vagal visceral pathways [35,37]. It was noted that ENS and its extended communication system could influence irritable bowel syndrome, psychiatric disorders, and neurological conditions among others [36,37]. In addition, ENS plays an important role in inflammatory and nociceptive processes, influencing neurogenic inflammation in visceral pain [38,39]. Furthermore, gut microbiota and its modulation has been described as anti-nociceptive in visceral, inflammatory, and neuropathic pain models in animal studies [36,38,39]. Its potential critical role was suggested in many other types of chronic pain, including inflammatory pain, neuropathic pain, headache and widespread musculoskeletal pain [40-43].

Some animal studies investigated the effects of somatic acupuncture on ENS and gut microbiota during the treatment of different diseases [44-46]. Jang et al. (2020) [45] suggested an association between the effects of acupuncture in enhancing motor function and protecting dopaminergic neurons, and the regulation of the gut microbial dysbiosis, determining the inhibition of neuroinflammation in mice affected by Parkinson's disease. Hong et al. (2020) [46] revealed a potential role of the gut-brain axis in increasing appetite and improving insomnia during acupuncture therapy. Visceral hyperalgesia was attenuated by electroacupuncture (EA), through down-regulation of central serotonergic activities in the brain-gut axis. Other studies discovered that EA at auricular points could increase mRNA expression of the 5-HT1a receptor in both the colon (peripheral) and raphe nuclei (central) in rats with induced visceral pain [47,48].

This evidence may be the basis for explaining the mechanisms behind the clinical efficacy of Bo's AA technique, particularly for visceral pathologies, pain, and neurological disorders. This method resulted in the effective management of TMD pain and related interference on life aspects like "sleep" in the present study. Furthermore, the insertion of needles directly on abdominal acupuncture points could suggest an amplified action of the ENS, thanks to the localized acupuncture-mediated anti-inflammatory effects already demonstrated in the literature [49,50]. This could further explain the recognized clinical evidence of a short-term therapeutic response to this acupuncture technique, especially for pain, that is reinforced by the results of the present study. Indeed, even after only one course of AA treatment (eight sessions) our patient population, characterized by subacute/chronic TMD pain non-responding to conventional gnathological therapy, conveyed a statistically significant decrease in pain, and pain-related disability in common activities and quality of life, for all the variables considered except for the aspect "walking ability" (Table 2). The parameters concerning mouth opening and general oral functioning was significantly improved (Table 2). These results are consistent with various clinical studies that support the abdominal acupuncture technique for the treatment of other kinds of musculoskeletal disorders such as cervical spondylosis, prolapse of lumbar intervertebral disc, knee osteoarthritis and shoulder periarthritis [30,31].

Furthermore, the AA clinical methodology has two important characteristics: (1) needles, after their insertion into the acupoints, are not manipulated; and (2) the location of the acupuncture points is particularly accurate, because the abdominal points are located by the practitioner measuring the horizontal and vertical lines of the AMS scheme with a ruler and converting the corresponding traditional measure

(cun) into centimeters [26]. So this technique, while avoiding needle stimulation and using a millimetric definition of acupoint location, is an easy-to-be-standardized repeatable method, as required by research methodology.

There are significant limitations to this study. Despite the evidence of clinical efficacy of AA on dysfunctional non-responder patients, this is a retrospective study on a small population of subjects. In addition, the data are not homogeneous regarding the presence or absence of painful systemic diseases. The promising results obtained, however, lay the basis for a randomized controlled clinical trial with a placebo group. Clinical trials are necessary to confirm the effectiveness of AA and to better explore the therapeutic possibilities of a microsystem method that is currently little investigated, but has strong performance in clinical acupuncture practice, especially for chronic pain.

AUTHORS' CONTRIBUTIONS

Conceptualization: E. Serritella, C. Di Paolo; Data curation and Formal analysis: E. Serritella, G. Galluccio; Investigation: E. Serritella; Project administration: C. Di Paolo; Supervision: E. Serritella, G. Galluccio, C. Di Paolo; Validation: E. Serritella, C. Di Paolo; Writing - original draft: E. Serritella; Writing - review & editing: E. Serritella, G. Galluccio, C. Di Paolo.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ORCID

Emanuela Serritella, https://orcid.org/0000-0003-4694-7032
Gabriella Galluccio, https://orcid.org/0000-0002-6876-8839
Carlo Di Paolo, https://orcid.org/0000-0002-1119-5742

REFERENCES

1. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al.; International RDC/TMD Consortium Network, International association for Dental Research; Orofacial Pain Special Interest Group, International Association for the Study of Pain. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. J Oral Facial Pain Headache 2014;28:6-27. https://doi.org/10.11607/jop.1151
2. Fernández-de-las-Penas C, Svensson P. Myofascial temporomandibular disorder. Curr Rheumatol Rev 2016;12:40-54. https://doi.org/10.2174/1573397112666151231110947
3. Poveda Roda R, Díaz Fernández JM, Hernández Bazán S, Jiménez Soriano Y, Margaix M, Sarrión G. A review of temporomandibular joint disease (TMJD). Part II: clinical and radiological semiology. Morbidity processes. Med Oral Patol Oral Cir Bucal 2008;13:E102-9.
4. Serritella E, Di Giacomo P, Vompi C, Falisi G, Di Paolo C. Longitudinal epidemiological analysis of three decades of TMD populations. Dent Cadmos 2020;88:527-36. https://doi.org/10.19256/d.cadmos.08.2020.07
5. Liu F, Steinkeler A. Epidemiology, diagnosis, and treatment of temporomandibular disorders. Dent Clin North Am 2013;57:465-79. https://doi.org/10.1016/j.cden.2013.04.006
6. Bitiniene D, Zamaliauskiene R, Kubilius R, Leketas M, Gailius T, Smirnovaite K. Quality of life in patients with temporomandibular disorders. A systematic review. Stomatologija 2018;20:3-9.
7. Conti PC, Pinto-Fiamengui LM, Cunha CO, Conti AC. Orofacial pain and temporomandibular disorders: the impact on oral health and quality of life. Braz Oral Res 2012;26 Suppl 1:120-3. https://doi.org/10.1590/s1806-83242012000700018
8. Maixner W, Diatchenko L, Dubner R, Fillingim RB, Greenspan JD, Knott C, et al. Orofacial pain prospective evaluation and risk assessment study--the OPPERA study. J Pain 2011;12(11 Suppl):T4-11.e1-2. https://doi.org/10.1016/j.jpain.2011.08.002
9. Pagé MG, Fortier M, Ware MA, Choinière M. As if one pain problem was not enough: prevalence and patterns of coexisting chronic pain conditions and their impact on treatment outcomes. J Pain Res 2018;11:237-54. https://doi.org/10.2147/JPR.S149262
10. Greenspan JD, Slade GD, Bair E, Dubner R, Fillingim RB, Ohrbach R, et al. Pain sensitivity and autonomic factors associated with development of TMD: the OPPERA prospective cohort study. J Pain 2013;14(12 Suppl):T63-74.e1-6. https://doi.org/10.1016/j.jpain.2013.06.007
11. Knuutila J, Kivipuro J, Näpänkangas R, Auvinen J, Pesonen P, Karppinen J, et al. Association of temporomandibular disorders with pain sensitivity: a cohort study. Eur J Pain 2022;26:143-53. https://doi.org/10.1002/ejp.1844
12. Sipilä K, Zitting P, Siira P, Niinimaa A, Raustia AM. Generalized pain and pain sensitivity in community subjects with facial pain: a case-control study. J Orofac Pain 2005;19:127-32.
13. Yuan QL, Wang P, Liu L, Sun F, Cai YS, Wu WT, et al. Acupuncture for musculoskeletal pain: a meta-analysis and meta-regression of sham-controlled randomized clinical trials. Sci Rep 2016;6:30675. https://doi.org/10.1038/srep30675
14. Law D, McDonough S, Bleakley C, Baxter GD, Tumilty S. Laser acupuncture for treating musculoskeletal pain: a systematic review with meta-analysis. J Acupunct Meridian Stud 2015;8:2-16. https://doi.org/10.1016/j.jams.2014.06.015
15. Wu JY, Zhang C, Xu YP, Yu YY, Peng L, Leng WD, et al.

Acupuncture therapy in the management of the clinical outcomes for temporomandibular disorders: a PRISMA-compliant meta-analysis. Medicine (Baltimore) 2017;96:e6064. https://doi.org/10.1097/MD.0000000000006064
16. Serritella E, Galluccio G, Impellizzeri A, Di Giacomo P, Di Paolo C. Comparison of the effectiveness of three different acupuncture methods for TMD-related pain: a randomized clinical study. Evid Based Complement Alternat Med 2021;2021: 1286570. https://doi.org/10.1155/2021/1286570
17. Grillo CM, Canales GD, Wada RS, Alves MC, Barbosa CM, Berzin F, et al. Could acupuncture be useful in the treatment of temporomandibular dysfunction? J Acupunct Meridian Stud 2015;8:192-9. https://doi.org/10.1016/j.jams.2014.12.001
18. Peixoto KO, da Silva Bezerra A, Melo RA, de Resende CMBM, de Almeida EO, Barbosa GAS. Short-term effect of scalp acupuncture on pain, sleep disorders, and quality of life in patients with temporomandibular disorders: a a randomized clinical trial. Pain Med 2021;22:905-14. https://doi.org/10.1093/pm/pnab048
19. Simma I, Simma L, Fleckenstein J. Muscular diagnostics and the feasibility of microsystem acupuncture as a potential adjunct in the treatment of painful temporomandibular disorders: results of a retrospective cohort study. Acupunct Med 2018;36:415-21. https://doi.org/10.1136/acupmed-2017-011492
20. Bo Z. Fuzhen Liaofa [Abdominal Acupuncture]. Beijing: Traditional Chinese Medicine Press, 1999. Chinese.
21. Scott T. Abdominal Acupuncture (fu zhen): energetics and clinical applications. J Chin Med 2008;87:16-8.
22. Lore R. Abdominal acupuncture: a practical introduction. J Chin Med 2007;83:29-32.
23. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. Int J Surg 2014;12:1495-9. https://doi.org/10.1016/j.ijsu.2014.07.013
24. Caraceni A, Mendoza TR, Mencaglia E, Baratella C, Edwards K, Forjaz MJ, et al. A validation study of an Italian version of the Brief Pain Inventory (Breve Questionario per la Valutazione del Dolore). Pain 1996;65:87-92. https://doi.org/10.1016/0304-3959(95)00156-5
25. Hecker HU, Steveling A, Peuker ET. Microsystems Acupuncture: The Complete Guide: Ear–Scalp–Mouth–Hand. New York: Thieme Medical Publishers, 2005.
26. Wang L, Zhang H. Discussion on the mechanisms of BO's abdominal acupuncture therapy. World J Acupunct Moxibustion 2013;23:52-9. https://doi.org/10.1016/S1003-5257(14)60013-1
27. Remien K, Majmundar SH. Physiology, fetal circulation. In: Aboubakr S, Abu-Ghosh A, Acharya AB, Adibi Sedeh P, Aeby TC, Aeddula NR, et al., eds. StatPearls [Internet]. Treasure Island: StatPearls Publishing; 2022 [cited 2022 Jun 13]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539710/
28. Hegazy AA. Anatomy and embryology of umbilicus in newborns: a review and clinical correlations. Front Med 2016;10: 271-7. https://doi.org/10.1007/s11684-016-0457-8
29. Grandjean M. New abdominal acupuncture: description with clinical examples. Med Acupunct 2010;22:197-201. https://doi.org/10.1089/acu.2009.0733
30. Wang Y, Zhang H, Miao Y, Yun J. Abdominal acupuncture and its management of musculoskeletal disorders. Dtsch Z Akupunkt 2013;56:13-7. https://doi.org/10.1016/j.dza.2013.11.004
31. Ho LF, Lin ZX, Leung AWN, Chen L, Zhang H, Ng BFL, et al. Efficacy of abdominal acupuncture for neck pain: a randomized controlled trial. PLoS One 2017;12:e0181360. https://doi.org/10.1371/journal.pone.0181360
32. Huang Y, Liao XM, Li XX, Song YB. Clinical observation on the effects of Bo's abdominal acupuncture in 40 cases of chronic fatigue syndrome. J Tradit Chin Med 2008;28:264-6. https://doi.org/10.1016/s0254-6272(09)60007-8
33. Iannuccelli C, Mannocci F, Guzzo MP, Olivieri M, Gerardi MC, Atzeni F, et al. Complementary treatment in fibromyalgia: combination of somatic and abdominal acupuncture. Clin Exp Rheumatol 2012;30(6 Suppl 74):112-6.
34. McMillin DL, Richards DG, Mein EA, Nelson CD. The abdominal brain and enteric nervous system. J Altern Complement Med 1999;5:575-86. https://doi.org/10.1089/acm.1999.5.575
35. Gershon MD, Margolis KG. The gut, its microbiome, and the brain: connections and communications. J Clin Invest 2021;131: e143768. https://doi.org/10.1172/JCI143768
36. Schneider S, Wright CM, Heuckeroth RO. Unexpected roles for the second brain: enteric nervous system as master regulator of bowel function. Annu Rev Physiol 2019;81:235-59. https://doi.org/10.1146/annurev-physiol-021317-121515
37. Collins SM, Surette M, Bercik P. The interplay between the intestinal microbiota and the brain. Nat Rev Microbiol 2012;10: 735-42. https://doi.org/10.1038/nrmicro2876
38. Vergnolle N. The enteric nervous system in inflammation and pain: the role of proteinase-activated receptors. Can J Gastroenterol 2003;17:589-92. https://doi.org/10.1155/2003/683731
39. Lucarini E, Parisio C, Branca JJV, Segnani C, Ippolito C, Pellegrini C, et al. Deepening the mechanisms of visceral pain persistence: an evaluation of the gut-spinal cord relationship. Cells 2020;9:1772. https://doi.org/10.3390/cells9081772
40. Clos-Garcia M, Andrés-Marin N, Fernández-Eulate G, Abecia L, Lavín JL, van Liempd S, et al. Gut microbiome and serum metabolome analyses identify molecular biomarkers and altered glutamate metabolism in fibromyalgia. EBioMedicine 2019;46: 499-511. https://doi.org/10.1016/j.ebiom.2019.07.031
41. Guo R, Chen LH, Xing C, Liu T. Pain regulation by gut micro-

biota: molecular mechanisms and therapeutic potential. Br J Anaesth 2019;123:637-54. https://doi.org/10.1016/j.bja.2019.07.026
42. Crock LW, Baldridge MT. A role for the microbiota in complex regional pain syndrome? Neurobiol Pain 2020;8:100054. https://doi.org/10.1016/j.ynpai.2020.100054
43. Freidin MB, Stalteri MA, Wells PM, Lachance G, Baleanu AF, Bowyer RCE, et al. An association between chronic widespread pain and the gut microbiome. Rheumatology (Oxford) 2021;60: 3727-37. https://doi.org/10.1093/rheumatology/keaa847
44. Xu X, Feng X, He M, Zhang Z, Wang J, Zhu H, et al. The effect of acupuncture on tumor growth and gut microbiota in mice inoculated with osteosarcoma cells. Chin Med 2020;15:33. https://doi.org/10.1186/s13020-020-00315-z
45. Jang JH, Yeom MJ, Ahn S, Oh JY, Ji S, Kim TH, et al. Acupuncture inhibits neuroinflammation and gut microbial dysbiosis in a mouse model of Parkinson's disease. Brain Behav Immun 2020;89:641-55. https://doi.org/10.1016/j.bbi.2020.08.015
46. Hong J, Chen J, Kan J, Liu M, Yang D. Effects of acupuncture treatment in reducing sleep disorder and gut microbiota alterations in PCPA-induced insomnia mice. Evid Based Complement Alternat Med 2020;2020:3626120. https://doi.org/10.1155/2020/3626120
47. Chen S, Wang S, Rong P, Wang J, Qiao L, Feng X, et al. Acupuncture for visceral pain: neural substrates and potential mechanisms. Evid Based Complement Alternat Med 2014;2014: 609594. https://doi.org/10.1155/2014/609594
48. Wang TQ, Li LR, Tan CX, Yang JW, Shi GX, Wang LQ, et al. Effect of electroacupuncture on gut microbiota in participants with knee osteoarthritis. Front Cell Infect Microbiol 2021;11: 597431. https://doi.org/10.3389/fcimb.2021.597431
49. Chu J. The local mechanism of acupuncture. Zhonghua Yi Xue Za Zhi (Taipei) 2002;65:299-302.
50. Li N, Guo Y, Gong Y, Zhang Y, Fan W, Yao K, et al. The anti-inflammatory actions and mechanisms of acupuncture from acupoint to target organs via neuro-immune regulation. J Inflamm Res 2021;14:7191-224. https://doi.org/10.2147/JIR.S341581