Does Modern Research Concerning Chinese Medicine Acupoints Relate to Original Prescriptions? If Not, Why Not?

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ABSTRACT

Objective: Huang Fu Mi's *Zhen Jiu Jia Yi Jing* (ZJJYJ) is regarded as the earliest text (282 CE) on differential diagnosis and clinical acupoint therapy in Chinese Medicine. Are contemporary manual acupuncture practices consistent with those reported in the ZJJYJ? The aim of this research was to investigate if modern manual acupuncture uses reported in research are consistent with classical practices reported in the ZJJYJ.

Materials and Methods: A database search of human research studies from 1995 to 2016 was performed for all 270 acupoints for all 8 leg/body channels. The clinical foci of these modern publications were compared with acupoint clinical indications documented in the Song Dynasty Chinese edition (1077) of the ZJJYJ and the sole English translation (translated and compiled by Yang and Chace in 1994) of *The Systematic Classic of Acupuncture and Moxibustion*.

Results: Of 2149 articles in English, 63 met the search criteria. These articles predominately reported acupoints on the lower leg, back, chest, and head. Correlations between the acupoints used in modern research and those used in the ZJJYJ were minimal. Clinical indications from the ZJJYJ typically involved symptoms relating to pain, swelling, fever, seizures, hallucinatory states, dysentery, malaria, and tuberculosis, which are now treated pharmacologically. However, one-third of modern studies were functional magnetic resonance imaging (fMRI) investigations of neurophysiologic effects of manual acupuncture on the human brain.

Conclusions: While, superficially, the ZJJYJ might seem irrelevant in modern manual acupuncture practices, well-documented physical effects (e.g., pain relief) of manual acupuncture do provide measurable outcomes for use in fMRI research. Therefore, the classical text does provide a guide for future research on influential acupoints on the leg and body channels.

Keywords: *The Systematic Classic of Acupuncture and Moxibustion*, *Zhen Jiu Jia Yi Jing*, Ruling Points, fMRI, research publications review, clinical symptom clusters

INTRODUCTION

THE ZHEN JIU JIA YI JING (ZJJYJ), compiled by Huang Fu Mi in 282 CE, is regarded as the earliest treatise on clinical acupoint therapy and differential diagnosis in Chinese Medicine (CM).¹ Mi's manuscript was methodically organized meticulous transcriptions of clinical and theoretical CM knowledge from 3 classical source texts, the *Su Wen*, the *Zhen Jing*, and the *Ming Tang*. Importantly,

the ZJJYJ is the only extant recording of content from the later lost *Ming Tang*, which, itself, was the earliest known text devoted to clinical acupuncture and moxibustion.²

The 12-volume manuscript was set out in 2 Parts, the second of which is central to the current study. This Part was comprised of 6 diagnostic Books (Book Seven to Book Twelve), with subsections arranged thematically according to patterns of diseases for different anatomical regions and organ systems with acupoints allocated accordingly.

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The valuable contribution of the *ZJJYJ* is still recognized in modern CM, owing to this treatise's systematic presentation of specific acupoints, termed *Ruling Points* (RPs), in relation to unique patterns of clinical signs and symptoms (RP indications), rather than offering a simple channel-based list. The RP system is central to Mi's method of differential diagnosis in the *ZJJYJ*.

In recent decades, there has been a surge in scientific research into the mechanism of acupuncture.³ However, it is not known if the directions of these studies correlate with the clinical indications detailed in the *ZJJYJ*. An initial examination concerning this question was completed in 2013 as a pilot study of all acupoints from the Large Intestine (LI) channel⁴; followed by a similar study in 2016 on all acupoints of the upper-limb channels (Lung, Pericardium, Triple Energizer, Small Intestine, and Heart).⁵ Both studies applied the same method and has been adopted in this research. These are detailed in the Materials and Methods section below. Briefly, the pilot study⁴ found that the LI channel acupoints were largely underrepresented in research articles, with only 116 articles meeting the study criteria. Of the 20 acupoints on the LI channel, 11 acupoints had studies identified, with 3 acupoints involved in multiple studies (LI 4, $n=81$; LI 10, $n=9$; and LI 11, $n=16$).

The clinical studies mostly focused on pain-related conditions ($n=75$) such as headache and musculoskeletal pain. Other studies concerned the gastrointestinal (GI) system, addiction, hypertension, immune responses, and mood disorders. Most of the 41 experimental studies identified involved using imaging techniques—for example, functional magnetic resonance imaging (fMRI)—to study the mechanisms of acupuncture.

Overall, the research topics for the studies had minimal relationships with the channel RP indications in the *ZJJYJ*. This might have been because the clinical indications listed in the *ZJJYJ* were predominantly the results of infectious diseases, pain syndromes, or chronic degenerative diseases. In modern times, such conditions are now largely addressed pharmacologically.

A similar research examination of the remaining arm-channel acupoints by Choi et al., in 2016,⁵ also resulted in limited findings between scientific research and the *ZJJYJ* RP indications. A major limitation in interpreting a possible relationship was the limited number of acupoints that were identified with appropriate research.

As with the LI channel, for each of the remaining arm channels, similar patterns with regard to modern articles were noted. Of 91 acupoints of the arm channels, only 11 acupoints (LI 4, LI 11, LI 10, LU 6, LU 7, LU 9, TE 3, TE 5, PC 6, PC 7, and HT 7) had 1 or more eligible studies.

A further consideration was the limited body regions, because, in both of the initial studies, only arm-channel points were involved.^{4,5} Therefore, the present study applied the same study method to the remaining 8 channels (of the

leg and torso) to facilitate similar comparisons to those that were made for the arm channels^{4,5} while investigating the relationships between modern studies and the *ZJJYJ*.

The current study's first aim was to review research studies available for the following 8 acupuncture channels: Governor Vessel (GV); Conception Vessel (CV); Bladder (BL); Kidney (KI); Stomach (ST); Spleen (SP); Gall Bladder (GB); and Liver (LR). The second aim was to compare the research foci of the identified studies to the RP indications of the *ZJJYJ* to identify possible correlations between modern uses of acupoints to classical uses of these acupoints.

MATERIALS AND METHODS

Data Collection from Databases

In keeping with the method detailed in Choi et al., in 2016,⁵ the database search was restricted to manual acupuncture. Techniques not equating with manual acupuncture as described and applied in the *ZJJYJ* back in 282 CE were excluded. RP indications relating to gynecology and pediatrics in the *ZJJYJ* were limited to a specialized short chapter at the end of Book Twelve; therefore, these studies in these two fields were not included in the analyses. Research studies using point combinations within a single intervention were included if the multiple acupoints were investigated for their individual active roles than for their combined effects. Three databases—MEDLINE,[®] AMED [Allied and Complementary Medicine], and EMBASE—that include acupuncture journals were searched. The criteria included articles from 1995 to 2016, English language, human studies, acupuncture, clinical and experimental trials, randomized and controlled clinical trials, and multicenter studies. This procedure was repeated for each acupoint on each of the 8 channels (GV, CV, BL, KI, ST, SP, GB, and LR).

Categorization System for Clinical Indications from the *ZJJYJ*

All indications reported for each acupoint were classified using the categorizations of RP indications presented in the *ZJJYJ*. The clinical indications used for the present study were collected from the sole English translation of the *ZJJYJ* (by Mi; compiled and translated by Yang and Chace, 1994)⁶ and the Song Dynasty Chinese edition from 1077.⁷ In *The Systematic Classic of Acupuncture and Moxibustion*,⁷ individual acupoints indicated groupings of signs and symptoms, and, for each grouping, the assigned acupoint was considered to be an RP. Yet, a single acupoint could have the role of an RP in one or more of the diagnostic Books. To establish a diagnostic profile of each acupoint, a coding system developed by Choi et al., in 2016,⁸ was used. All RPs were coded according to their occurrence in the

FIG. 1. Adapted PRISMA [Preferred Reporting Items for Systematic Reviews and Meta-Analyses]⁹ flowchart of studies screened and assessed for eligibility. AMED, Allied and Complementary Medicine, TENS, transcutaneous electrical nerve stimulation, EA, electroacupuncture.

relevant diagnostic Book (B), Chapter (C), and Part (P). Once all of the RPs were coded according to the method devised by Choi et al., in 2016,⁸ the clusters of signs and symptoms for each RP were collated.

RESULTS

The database search returned 2149 articles on 270 acupoints across the 8 channels investigated. After removing 1633 study duplications, the abstracts of the remaining studies ($n = 516$) were screened for exclusions, such as laser acupuncture, transcutaneous electrical nerve stimulation, electroacupuncture (EA), pharmacopuncture, moxibustion,

mixed interventions, acupressure, case studies, systematic reviews, and acupoint combinations. Some of these techniques can be representative of what is expected in a modern clinical setting; however, they could not be included in the survey as they do not reflect practices used around the time of Mi. This resulted in 453 studies being excluded and left 63 eligible studies for analysis.⁹ See Figure 1 and Table 1. Most studies were related to the lower leg, back, chest, and head. For each channel, only a few acupoints were represented in studies that met the search criteria. See Figure 2. Tables 2–9^{10–60} show further breakdowns of studies according to individual acupoints. Overall, there were more experimental ($n = 49$) than clinical studies ($n = 14$). See Figure 3.

TABLE 1. SUMMARIZED STUDY DATA IN FIGURE 1 FOR INDIVIDUAL CHANNELS

Status of studies	GV	CV	BL	KI	ST	SP	GB	LR	Total
Database total located	207	260	386	81	556	293	207	159	2149
Duplicates excluded	111	213	321	46	475	204	181	82	1633
Studies retained	96	47	65	35	81	89	26	77	516
Inclusion criteria failed	90	41	61	29	65	84	18	65	453
Inclusion criteria met	5	5	3	6	19	5	8	12	63
Retained studies that compared multiple channel-point interventions	3	3	1	1	11	4	2	4	29
Acupoints with no articles	10	8	27	17	15	10	21	7	115
Acupoints with articles that met inclusion criteria	4	4	3	4	5	2	3	3	28
Total number of acupoints in the channel	28	24	67	27	45	21	44	14	270

GV, Governor Vessel; CV, Conception Vessel; BL, Bladder; KI, Kidney; ST, Stomach; SP, Spleen; GB, Gall Bladder; LR, Liver.

Channel:	GV	CV	BL	KI	ST	SP	GB	LR
Acupoints:	1	1	67	1	45	1	44	1
	2	2	66	2	44	2	43	2
	3	3	65	3	43	3	42	3
	4	4	64	4	42	4	41	4
	5	5	63	5	41	5	40	5
	6	6	62	6	40	6	39	6
	7	7	61	7	39	7	38	7
	8	8	60	8	38	8	37	8
	9	9	59	9	37	9	36	9
	10	10	58	10	36	10	35	10
	11	11	57	11	35	11	34	11
	12	12	56	12	34	12	33	12
	13	13	55	13	33	13	32	13
	14	14	54	14	32	14	31	14
	15	15	53	15	31	15	30	
	16	16	52	16	30	16	29	
	17	17	51	17	29	17	28	
	18	18	50	18	28	18	27	
	19	19	49	19	27	19	26	
	20	20	48	20	26	20	25	
	21	21	47	21	25	21	24	
	22	22	46	22	24		23	
	23	23	45	23	23		22	
	24	24	44	24	22		21	
	25		43	25	21		20	
	26		42	26	20		19	
	27		41	27	19		18	
	28		40		18		17	
			39		17		16	
			38		16		15	
			37		15		14	
			36		14		13	
			35		13		12	
			34		12		11	
			33		11		10	
			32		10		9	
			31		9		8	
			30		8		7	
			29		7		6	
			28		6		5	
			27		5		4	
			26		4		3	
			25		3		2	
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			4					
			3					
			2					
			1					

FIG. 2. Shows for each channel which acupoints had research publications that met the inclusion criteria (dark gray shading) or not (light gray shading); no publications are not shaded.

TABLE 2. ARTICLES ON GV CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE ZJJYJ CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Agreement with ZJJYJ
GV 14		
Karatay, 2011 ¹⁰	Immune function	X
GV 20		
Byeon, 2011 ¹¹	Cerebral blood flow	X
Sato, 2009 ¹²	Arterial stiffness (blood pressure)	X
Huang, 2007 ¹³	fMRI (vascular dementia)	X
GV 24		
Lu, 2013 ¹⁴	Anxiety	X
GV 26		
Huang, 2007 ¹³	fMRI (vascular dementia)	X

Light gray shading indicates experimental studies; dark gray shading indicates that the same studies reported on more than 1 acupoint.

X indicates no relationship to the ZJJYJ.

ZJJYJ, *Zhen Jiu Jia Yi Jing*.

Note that 12 articles investigated multiple acupoints. Given that each article was counted as a study for each acupoint that it examined, this artificially boosted the total number of studies to 27.

GV Channel

The 28 GV acupoints run from the coccyx up the posterior midline to wrap over the head and face. Ten acupoints had no articles identified. The 5 studies that met the criteria were experimental, investigating acupoints located from the

TABLE 3. ARTICLES ON CV CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE ZJJYJ CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with ZJJYJ
CV 12		
Minagawa, 2013 ¹⁵	Autonomic functions	✓
Mori, 2010 ¹⁶	Pupillary response	X
CV 16		
Kurono, 2011 ¹⁷	Heart rate variability	X
CV 17		
Kurono, 2011 ¹⁷	Heart rate variability	X
CV 24		
Rosler, 2003 ¹⁸	Gag reflex	X
Rosted, 2006 ¹⁹	Gag reflex	X

Light gray shading indicates experimental studies; dark gray shading indicates that the same studies reported on more than 1 acupoint.

X indicates no relationship to the ZJJYJ; ✓ indicates a relationship with the ZJJYJ.

ZJJYJ, *Zhen Jiu Jia Yi Jing*.

TABLE 4. ARTICLES ON BL CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE ZJJYJ CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with ZJJYJ
BL 20		
Minagawa, 2013 ¹⁵	Autonomic functions	✓
BL 32		
Minagawa, 2013 ¹⁵	Autonomic functions	X
BL 33		
Honjo, 2004 ²⁰	Chronic pelvic pain	X
Honjo, 2000 ²¹	Urinary incontinence	✓

Dark gray shading indicates that the same studies reported on more than 1 acupoint.

X indicates no relationship to the ZJJYJ; ✓ indicates a relationship with the ZJJYJ.

ZJJYJ, *Zhen Jiu Jia Yi Jing*.

posterior neck to the philtrum on the lip. The sole fMRI study investigated the effects of GV 20, GV 26, and HT 7 on brain activity in participants with vascular dementia. Other studies were related to immune function and anxiety. None of the studies reflected specific clinical indications in the ZJJYJ. See Table 2.^{10–14}

CV Channel

The 24 CV acupoints run up the anterior midline from the perineum to the chin. No articles were identified for 8 acupoints. The 5 studies that met the criteria involved 4 acupoints located on the abdomen, chest, and chin. Only 1 study (Minagawa et al., 2013)¹⁵ investigated the ZJJYJ RP

TABLE 5. ARTICLES ON KI CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE ZJJYJ CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with ZJJYJ
KI 1		
Gemma, 2015 ²²	Recovery from surgery	X
KI 3		
Zhu, 2015 ²³	fMRI (cortical function)	X
Liu, 2014 ²⁴	fMRI (cognitive impairment)	X
Feng, 2012 ²⁵	fMRI (cognitive impairment)	X
KI 6		
Vickland, 2008 ²⁶	Electrodermal activity	X
KI 9		
Lee, 2015 ²⁷	Alcohol dependence	X

Light gray shading indicates experimental studies.

X indicates no relationship to the ZJJYJ.

ZJJYJ, *Zhen Jiu Jia Yi Jing*; fMRI, functional magnetic resonance imaging.

TABLE 6. ARTICLES ON ST CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE *ZJYYJ* CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with <i>ZJYYJ</i>
ST 7		
Mori, 2010 ¹⁶	Pupillary response	X
ST 36		
Li, 2014 ²⁸	fMRI (pain)	X
Minagawa, 2013 ¹⁵	Autonomic functions	✓
Hui, 2005 ²⁹	fMRI (cerebral function)	X
Liu, 2011 ³⁰	fMRI (cerebral function)	X
Mori, 2010 ¹⁶	Pupillary response	X
Zhou, 2014 ³¹	Neural electrical signals	X
Claunch, 2012 ³²	fMRI (acu mechanism)	X
Cho, 2010 ³³	fMRI (cerebral function)	X
Karatay, 2011 ¹⁰	Immune function	X
Wang, 2014 ³⁴	Cerebral blood flow	X
Park, 2010 ³⁵	Hypertension	X
Hui, 2009 ³⁶	fMRI (acu mechanism)	X
Hui, 2010 ³⁷	fMRI (acu mechanism)	X
Ozerkan, 2007 ³⁸	Knee-extension ability	X
Huang, 2012 ³⁹	Dyspepsia	✓
ST 38		
Lin, 2005 ⁴⁰	Frozen shoulder	X
ST 43		
Wang, 2000 ⁴¹	Pulse spectrum	X
ST 44		
Lietz, 2008 ⁴²	CAEP	X
Usichenko, 2011 ⁴³	BAEP	X

Light gray shading indicates experimental studies; dark gray shading indicates that the same studies reported on more than 1 acupoint.

X indicates no relationship to the *ZJYYJ*; ✓ indicates a relationship with the *ZJYYJ*.

ZJYYJ, *Zhen Jiu Jia Yi Jing*; fMRI, functional magnetic resonance imaging; acu, acupuncture; CAEP, cortical auditory-evoked potentials; BAEP, brainstem auditory-evoked potentials.

TABLE 7. ARTICLES ON SP CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE *ZJYYJ* CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with <i>ZJYYJ</i>
SP 6		
Karatay, 2011 ¹⁰	Immune function	X
Wang, 2014 ³⁴	Cerebral blood flow	X
Lu, 2013 ¹⁴	Anxiety	X
Filshie, 2005 ⁴⁴	Night sweats and hot flashes (cancer)	X
SP 9		
Pfab, 2010 ⁴⁵	Eczema	X

Light gray shading indicates experimental studies.

X indicates no relationship to the *ZJYYJ*.

ZJYYJ, *Zhen Jiu Jia Yi Jing*.

TABLE 8. ARTICLES ON GB CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE *ZJYYJ* CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with <i>ZJYYJ</i>
GB 34		
Jeun, 2005 ⁴⁶	fMRI (motor cortex stimulation)	X
Chae, 2009 ⁴⁷	fMRI (brain activity)	X
Yeo, 2014 ⁴⁸	fMRI (Parkinson's disease)	X
GB 37		
Liu, 2013 ⁴⁹	fMRI (signals to visual cortex)	X
Chiu, 2011 ⁵⁰	Eye pain post laser surgery	X
GB 43		
Wesolowski, 2009 ⁵¹	fMRI (signals to primary auditory cortex)	✓
Lietz, 2008 ⁴²	CAEP	✓
Usichenko, 2011 ⁴³	BAEP	✓

Light gray shading indicates experimental studies.

X indicates no relationship to the *ZJYYJ*; ✓ indicates a relationship with the *ZJYYJ*.

ZJYYJ, *Zhen Jiu Jia Yi Jing*; fMRI, functional magnetic resonance imaging; CAEP, cortical auditory-evoked potentials; BAEP, brainstem auditory-evoked potentials.

indications experimentally on gastric function in general for CV 12. In the classic publication, CV 12 is an RP for addressing GI system conditions, such as abdominal distension, pain, undigested food in stools, borborygmus, and intestinal protrusions. See Table 3.^{15–19}

BL Channel

The 67 BL acupoints run from the fifth toe up the posterior aspect of the leg, back, and over the head to the inner corner of the eye. There were 27 acupoints with no articles identified. The 3 research studies that met the criteria involved acupoints located on the mid-back to the sacrum. There were both clinical and experimental studies; BL 20 and BL 32 were a part of the same study by Minagawa et al., in 2013,¹⁵ which investigated the effect of acupuncture on cardiac and gastric autonomic functions at selected acupoints (CV 12, PC 6, BL 20, BL 32, and ST 36). While the RP indications for BL 32 did not address cardiac and gastric symptoms, BL 20 did support the original intended use of abdominal distension, pain, masses, and accumulations. Both clinical studies for BL 33 were concerned with the pelvic region. Honjo et al., in 2000,²¹ focused on addressing urinary incontinence in patients with spinal-cord injuries, which had some relationship to the traditional use. The *ZJYYJ* BL 33 RP indications were concerned with lumbar back pain, bowel movements, and urinary retention. See Table 4.^{15,20,21}

TABLE 9. ARTICLES ON LR CHANNEL ACUPOINTS, ASSOCIATED RESEARCH FOCI & RELATIONSHIP WITH THE *ZJJYJ* CLINICAL INDICATIONS

Articles: First author, year & reference for each acupoint	Research foci	Research agreement with <i>ZJJYJ</i>
LR 2		
Chae, 2009 ⁵²	fMRI (acu mechanism)	X
Fang, 2009 ⁵³	fMRI (neuromechanism)	X
LR 3		
Wu, 2010 ⁵⁴	fMRI (neuromechanism)	X
Wu, 2008 ⁵⁵	fMRI (neuromechanism in cerebral palsy)	X
Tsuruoka, 2013 ⁵⁶	Acu mechanism	X
Takayama, 2010 ⁵⁷	Acu mechanism on hemodynamics	X
Takayama, 2010 ⁵⁸	Acu mechanism on hemodynamics	X
Claunch, 2012 ³²	fMRI (acu mechanism)	X
Hui, 2009 ³⁶	fMRI (acu mechanism)	X
Hui, 2010 ³⁷	fMRI (acu mechanism)	X
Yan, 2005 ⁵⁹	fMRI (acu mechanism)	X
LR 5		
Luo, 2010 ⁶⁰	Cervical spondylosis	X

Light gray shading indicates experimental studies.

X indicates no relationship to the *ZJJYJ*.

ZJJYJ, *Zhen Jiu Jia Yi Jing*; fMRI, functional magnetic resonance imaging; acu, acupuncture.

KI Channel

The 27 KI acupoints run superiorly from the plantar surface to the medial leg, abdomen, and chest. There were 17 acupoints with no articles identified. The 6 research studies meeting the criteria included acupoints located on the foot and medial aspect of the lower leg. Three studies were fMRI studies investigating the needling effects of KI 3 on the brain in relation to cognitive impairment. None addressed the classical clinical indications in the *ZJJYJ*. See Table 5.^{22–27}

ST Channel

The 45 ST acupoints are positioned from the second toe, and go up the anterior leg and torso to the face. There were 15 acupoints with no articles identified. The 20 studies that met the criteria included facial and anterior lower-leg acupoints. Six of the 7 fMRI studies identified investigated the cerebral neuronal activity changes during manual acupuncture stimulation at ST 36. Only studies involving ST 36 reflected the clinical use of the acupoints in the *ZJJYJ*. Both Minagawa et al., in 2013,¹⁵ and Huang et al., in 2012,³⁹ investigated the same area (the GI system) that clinically related to the *ZJJYJ* for treating abdominal fullness, frequent belching, bowel-movement issues, and undigested food. See Table 6.^{10,15,16,28–43}

SP Channel

The 21 SP acupoints are located on the first toe, go up the medial leg to the abdomen, and go up to the lateral aspect of the chest in the sixth intercostal space. No articles were identified for 10 acupoints. The 5 studies that met the criteria involved acupoints on the lower medial leg. Their clinical foci ranged across the immune system, cerebral blood flow, anxiety, vasomotor symptoms in patients with cancer, and eczema. None reflected the *ZJJYJ* RP indications. See Table 7.^{10,14,34,44,45}

GB Channel

The 44 GB acupoints run from the fourth toe; go up the lateral leg, hip, and gluteal region; and continue up the lateral aspect of the abdomen and chest toward the temporal region. There were 21 acupoints with no articles identified. All 8 studies that met the criteria included acupoints on the lateral lower leg; 5 were fMRI studies. Three studies investigated GB 43 for auditory specific effects, which shared similarity to the *ZJJYJ* RP indications for deafness with ringing in the ears. Three fMRI studies on GB 34 investigated associated electrical

FIG. 3. A comparison in the number of clinical studies (dark gray) versus experimental studies (light gray) between the channels.

activity in the motor cortex in relation to movement disorders. See Table 8.^{42,43,46–51}

LR Channel

The 14 LR acupoints run from the first toe and go up the medial leg to the lateral aspect of the abdomen and chest in the sixth intercostal space. For 7 acupoints no articles were identified. All 12 studies meeting the criteria were experimental investigations of the mechanisms of acupuncture, using acupoints located on the foot and ankle. The LR-channel studies had a special interest in fMRI ($n=8$) and in the areas of the brain that are activated by acupuncture stimulation at LR 2 and LR 3. No studies reflected the *ZJJYJ* RP indications. See Table 9.^{32,36,37,52–60}

Comparisons Between Modern Studies and RP Indications

Many acupoints had multiple RP indications documented from different sections of the *ZJJYJ*; however, modern studies only addressed single clinical indications. Of 28 acupoints that had articles identified, 5 acupoints were used in studies that investigated 1 or more of the RP indications listed in the *ZJJYJ*. See Table 10.^{15,39,42,43,51} For example, CV 12 had 4 RP indications concerning gastric functions from B8C2, B8C3, B9C2, and B9C7, and this was the research focus in Minagawa et al., in 2013,¹⁵ who investigated 2 other acupoints (BL 20 and ST 36) for possible gastric functions. Huang et al., in 2012,³⁹ looked at ST 36 for treating dyspepsia, which strongly correlated with the *ZJJYJ*, where half of the RP indications are concerned with gastric symptoms. One study (Honjo et al., 2000²¹) used BL 33 to treat urinary incontinence that related to the RP indication from B9C11 to treat urinary dysfunction. For GB 43, the 3 research articles (Weslowski et al., in 2009,⁵¹ Lietz et al., in 2008,⁴² and Usichenko et al., in 2011⁴³) identified the point use to be “auditory”- or “ear”-specific and, therefore, the researchers investigated the potential effect of manual acupuncture on the auditory cortex. Auditory symptoms were one of 4 RP indications, found in B7C1P3. See Table 10.^{15,21,39,42,43,51}

DISCUSSION

The current study looked at 8 CM channels of the leg and body; according to the *ZJJYJ*, these channels have a total of 270 acupoints. In the 1995–2016 research article survey for the total 270 acupoints, no articles were found on 115 acupoints (43%), including 20 of the 35 points without RPs designated in the *ZJJYJ*. In terms of clinical or experimental directions, most of the articles concerned experimental studies ($n=49$), with only 14 clinical studies, as shown in Figure 3.

Across the channels, acupoints were located from the soles of the feet, legs, torso, head, and face. However, predomi-

nantly, articles meeting the research criteria involved acupoints located on the lower legs ($n=16$), with the remainder of the acupoints ($n=12$) located on the back, chest, and head. ST 36 was the most widely reported point, with 15 studies (24%); followed by LR 3, which had 9 studies (14%); SP 6 with 4 studies (6%); GV 20, GB 34, GB 43, and KI 3, all with 3 studies each (5% each); and the remaining 21 acupoints with 1 or 2 studies each (36%).

ST 36 stood out in terms of the number of studies and the types of research involved. Seven of the 15 studies used fMRI techniques to investigate the effects of acupuncture on the different areas of the brain; the remainder of the studies ranged across the autonomic functions, vascular systems, immune function, central nervous system (CNS), knee extension, and dyspepsia.

All 9 LR 3 articles were about experimental studies that investigated the mechanism of acupuncture on the nervous and circulatory systems. Six were fMRI studies, similar to the ones identified for ST 36. The 4 SP 6 studies included experimental and clinical studies, each with different foci: immune function¹⁰; cerebral blood flow³³; anxiety¹⁴; and vasomotor symptoms in patients with cancer.⁴³

Interestingly, a study by Aird, in 2005,⁶¹ used similar selection criteria to the present study (except that the Aird study included EA and point combinations), surveying published research for 361 channel acupoints from 1995 to 2000. The Aird study showed the top commonly used acupoints in research were on the leg and body channels: ST 36; SP 6; GV 20; LR 3; BL 23; and KI 3. This corresponded to the current study findings; in particular, ST 36 was by far the most-investigated acupoint for both studies, followed by LR 3, SP 6, GV 20, and KI 3.

Study findings of Cobbin et al., 2014⁴ showed that pain modulation was a major research interest among acupuncture research articles on the LI channel, in particular, the LI 4 and LI 11 acupoints. This was supported by studies such as Lee and Wang, in 2009,⁶² establishing that the mechanism of acupuncture analgesia was due to increased release of endogenous opioid peptides in the CNS and that common fever is also centrally mediated and involves alteration of the hypothalamic temperature set point in response to pyrogenic factors (per Guyton and Hall).⁶³ The established role of endorphins in the CNS provides a plausible rationale for the number of neuroimaging techniques used, such as the fMRI studies in Cobbin et al., in 2014.⁴ That study found that, between 1995 and 2013, there was widespread research interest in understanding possible relationships between cerebral functions and manual acupuncture. Meanwhile, for the leg and body channels, there has not been the same number of reliable studies to suggest a similar role of endorphins mediated by the CNS during manual acupuncture. However, the current study brings to light that there is a steady interest in a select few acupoints on the leg—such as ST 36, LR 3, GB 34, and KI 3—for understanding the mechanism of manual acupuncture on the brain by using fMRI.

TABLE 10. COMPARISON BETWEEN MODERN RESEARCH STUDIES AND RP INDICATIONS FROM THE *ZJJYJ*

Articles: First
author, year
& reference

Acupoints

Research foci: Article titles

RP indications from *ZJJYJ*^a

Minagawa, 2013 ¹⁵	CV 12	Autonomic functions: Site-specific organ-selective effect of epifascial acupuncture on cardiac and gastric autonomic functions	B8C2: Gastrointestinal tract: “ <i>abdominal distention</i> ” B8C3: Internal organ “distention”: “ <i>stomach distention</i> ” B9C2: Cardiac dysfunction: “ <i>abdominal distention and pain</i> ” B9C4: Thoracic/epigastric/gastric regions (lung, stomach, esophagus) B9C7: Abdomen (stomach/small intestine): “ <i>abdominal distention, inability to transform food and drink</i> ” B9C11: Lower abdomen/urogenital dysfunction B10C6: Spillage of rheum B7C4: Tetany B8C1P2: Cold and heat—external pathogenic attack: “ <i>inability to ingest food, abdominal distention and pain</i> ” B8C3: Internal organ “distention” B9C7: Abdomen (stomach/small intestine): “ <i>stomach pain, no desire for food</i> ” B11C6: Jaundice: “ <i>desire to vomit</i> ” B7C1P3: Febrile disease: “ <i>pain in abdomen and frequent retching</i> ” B7C2: Delirium, hallucinations, mania B7C4: Tetany B8C4: Abdominal swelling/ascites B9C7: Abdomen (stomach/small intestine): “ <i>frequent belching, aversion of food, insufficiency of the stomach qi, pain in the abdomen, distention below the heart</i> ” B11C4: Sudden turmoil B11C6: Jaundice: “ <i>swift digestion of grains, rapid hunger, heat in abdomen</i> ” B11C7: Chest (retching blood)
	BL 20		
	ST 36		
Honjo, 2000 ²¹	BL 33	Urinary incontinence: Acupuncture on clinical symptoms and urodynamic measurements in spinal-cord-injured patients with detrusor hyperreflexia	B8C3: Internal organ “distention” B9C8: Lower abdomen/lumbar region (intestinal/kidneys) B9C11: Lower abdomen/urogenital dysfunction: “ <i>dribbling urinary qi blockage in males</i> ”
Huang, 2012 ³⁹	ST 36	Dyspepsia: Acupuncture effects on the pulse spectrum of radial pressure pulse in dyspepsia	B7C1P3: Febrile disease: “ <i>pain in abdomen and frequent retching</i> ” B7C2: Delirium, hallucinations, mania B7C4: Tetany B8C4: Abdominal swelling/ascites B9C7: Abdomen (stomach/small intestine): “ <i>frequent belching, aversion of food, insufficiency of the stomach qi, pain in the abdomen, distention below the heart</i> ” B11C4: Sudden turmoil B11C6: Jaundice: “ <i>swift digestion of grains, rapid hunger, heat in abdomen</i> ” B11C7: Chest (retching blood): “ <i>pain in the diaphragm</i> ”
Wesolowski, 2009 ⁵¹	GB 43	fMRI (signals to primary auditory cortex): Acupuncture reveals no specific effect on primary auditory cortex: A functional magnetic resonance imaging study	B7C1P3: Febrile disease: “ <i>deafness and ringing in the ears</i> ”
Lietz, 200 ⁴²		CAEP: Acupuncture of specific points influences cortical auditory evoked potentials—a volunteer crossover study	B7C5: Quartan <i>nue</i> B9C4: Thoracic/epigastric/gastric regions (lung, stomach, esophagus) B11C2: Mania/insanity
Usichenko, 2011 ⁴³		BAEP: Acupuncture does not influence brainstem auditory evoked potentials: A volunteer crossover study	

^aRP indications have been coded to show which Book (B), Chapter (C), Part (P) they are from. The direct descriptions used in the *The Systematic Classic of Acupuncture and Moxibustion* (refs. 6 & 7) for each RP indication have been included and highlighted in gray.

RP, ruling point; fMRI, functional magnetic resonance imaging; CAEP, cortical auditory-evoked potentials; BAEP, brainstem auditory-evoked potentials.

Growth in interest in imaging technology since the mid-1990s has permitted such investigatory studies, which previously had not been explored.⁶⁴ The benefit of such neuroimaging techniques is the noninvasive methods that allow studies on human subjects.⁵⁹ More than one-third (35%) of the research articles involved fMRI studies. With a few exceptions,^{24,25,46,47,55} the studies involved healthy subjects.

The good-quality studies on healthy subjects provide an understanding of how interventions might affect brain function and allow adequate baseline measures for future research. An example of this is a study completed by Hui et al., in 2010,³⁶ which provided encouraging findings with regard to fMRI monitoring during manual acupuncture to LI 4, LR 3, and ST 36; these acupoints were chosen based on established knowledge of their modulatory and pain-reducing actions. The Hui et al. study concluded that manual acupuncture at those acupoints modulates the limbic system, which is an important intrinsic regulatory system of the human brain.³⁶ Another notable fMRI study was by Yan et al., in 2005,⁵⁹ in which LR 3 and LI 4 were explored for deactivation patterns of the frontal area in analgesia and activation of the visual cortex to correlate with eye disorders. Yan et al. concluded that manual acupuncture at different acupoints elicits different fMRI activation patterns in the brain. Studies like these provide supporting evidence for the underlying mechanisms in acupuncture.

Furthermore, with increased research into the mechanisms of acupuncture adding to clinical and experimental data, there are potentially more discoveries to be made, including the 35 acupoints that were not recommended for acupuncture in the *ZJJYJ*. Originally, these points might not have been seen as functional because of the inability to detect a treatment effect; however, with the availability of imaging techniques, there is prospective expansion in the number of functional acupoints. Fifteen of those acupoints have already been incorporated into research articles in which most of these acupoints were used to treat conditions that were local to the acupoints.

CONCLUSIONS

The current study showed that looking at the RP indications alone from *ZJJYJ* is no longer relevant in the modern medical context, as most of the conditions addressed in the *ZJJYJ* are now largely treated pharmacologically and with skillful surgery. However, a significant finding from this study is the growing interest in neuroimaging techniques that have allowed investigation into the mechanisms of acupuncture and its effects on the human brain. Progressively, studies support the effects of manual acupuncture on the CNS. The acupoints of interest in these experimental studies are ST 36, LR 6, SP 6, GV 20, GB 34, GB 43, and KI 3. What seems to be overlooked is that CM and Western Medicine both continue to evolve with advances in biomedical knowledge. However, what has become clear is that

manual acupuncture is used differently from what was intended back in 282 CE. The way manual acupuncture is understood and practiced has evolved with the availability of neuroimaging techniques that are now used to aid understanding of the underlying mechanisms of acupuncture. Therefore, although, superficially, it appears that the *ZJJYJ* is no longer relevant in modern acupuncture practices, this treatise does provide a guide for what parts of the body are influenced by particular acupoints.

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