



Original Article

The Implications of X-ray Use in Chuna Manual Therapy from the Viewpoint of Korean Medicine Doctors



Tae Gyu Kim ^{1,*}, Yumi Gi ¹, Kyu Jin Yang ¹, Ki-Beom Lee ¹, Hoojin Jo ¹, Jongho Choi ¹, Yoon Jae Lee ², Sanghun Lee ³, In-Hyuk Ha ²

¹ Jaseng Hospital of Korean Medicine, Seoul, Korea

² Jaseng Spine and Joint Research Institute, Jaseng Medical Foundation, Seoul, Korea

³ Future Medicine Division, Korea Institute of Oriental Medicine, Daejeon, Korea

ABSTRACT

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Background: The purpose of this survey study was to understand how utilization of X-rays as an adjunct to Chuna manual therapy (CT) supports treatment, as assessed by Korean medicine doctors (KMDs).

Methods: A survey was emailed to all 18,289 members of the Association of Korean Oriental Medicine (AKOM) to determine the implications of X-ray use in CT. Surveys were collected from September 22, 2017 to October 15, 2017.

Results: Of the 18,289 KMDs 562 completed the survey. The implications of a radiological diagnosis (X-ray) with CT was assessed using 5 items in a questionnaire: time to diagnosis, accuracy of treatment, patient comprehension and satisfaction, CT effect, and safety of CT. Survey participants identified improvement in patient comprehension and satisfaction as the most important factor for X-ray use with CT, followed by increased safety of CT. From the determinant factors for selection of CT intensity and specific techniques, severity of clinical symptoms was shown to be the most influential factor. Degenerative changes of the spine and degree of spinal malposition were also reported to be highly influential.

Conclusion: The KMDs that participated in this study indicated that utilization of X-rays in conjunction with CT administration improved patient comprehension and satisfaction, and CT safety. Installation of radiological equipment in Korean medicine clinics where CT is provided may increase safety and patients' satisfaction.

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Introduction

Chuna manual therapy (CT) refers to Korean medicine treatment and prevention of disease through adjustment of joints, spinal alignment, and muscles, ligaments and nervous system stimulation applied to the patient's body surface using the practitioner's hands, other body parts, or assisting devices when positioned on a Chuna table [1]. For accurate and safe administration of CT, it is necessary to accurately diagnose and evaluate the overall state and imbalance in structural disorder and associated function. Diagnosis and evaluation of the overall imbalance should take into consideration functional muscle tests based on a thorough knowledge of anatomy, examination of possible joint malposition, laboratory tests, and radiological imaging [1].

Until recently, a recommendation for CT was solely based on motion and static palpation without X-ray examination. As a consequence, personal differences in clinical experience and

expertise limited diagnoses in terms of objective, and consistent systematic evaluation of malposition and dysfunction. There has since been an increase in use of simple radiological imaging (X-ray) in an effort to overcome this diagnostic limitation in the deduction of rational diagnosis and prognosis [2]. Oh et al [3] radiologically evaluated the effect of Bong CT (using a type of stick called 'Bong') on the improvement of cervical curvature of the spine, and Lee et al [4] reported a case on the radiological changes of spondylolisthesis as a result of Cox therapy and acupuncture treatment. Park et al [5] reported 3 cases of pelvic, spine and shoulder girdle malalignment treatment using CT where full spine anteroposterior X-rays were utilized for outcome measurement. Also, Lee et al [6] utilized lumbar CT and X-rays in the evaluation of morphological changes in spinal alignment following conservative treatment, in a clinical study to determine the effects of conservative treatment along with CT, for patients with lower back pain. As such, there are a modest number of Korean medicine studies pertaining to the use of X-rays

*Corresponding author.
Jaseng Hospital of Korean Medicine, Seoul, Korea
E-mail: taegyu4860@jaseng.co.kr

regarding CT administration, and numerous other diagnostic and prognostic studies. Cho et al [7] purported that only femoral head height difference may be used as a significant index in prognosis for lower back pain and Bae et al [8] investigated the potential relationship between pelvic insufficiency and the region of lower back pain using radiological analysis, concluding that pelvic malposition and the lower back pain region was unrelated.

Whilst numerous Korean medicine studies have been published on the use of X-rays to enhance diagnosis or prognosis, most did not include CT administration. Moreover, there are currently no studies that have investigated the implications of X-ray use in CT administration from the practitioners' perspective (Korean medicine doctor). Therefore, the aim of this study was to assess the Korean medicine doctors' opinion on the implications of X-ray use with CT.

Materials and Methods

Study methods

With cooperation from the Association of Korean Oriental Medicine (AKOM), a survey was sent via e-mail to all 18,289 AKOM members. It was initially sent on September 22, 2017, and in an effort to increase response rate, a second e-mail was sent as a reminder on October 10, 2017. Two short message services (SMSs) were also sent to promote an e-mail response. The survey was conducted from September 22, 2017 to October 15, 2017.

Statistics

Statistical analysis was performed using TATA 14.0 (StataCorp, College Station, Texas, USA). Continuous data are presented as mean \pm SD, and nominal data as frequency and percentage.

Items and method of survey

The survey consisted of 7 items inquiring into participant gender, age, clinical experience, type of medical institution currently affiliated with, and 4 items regarding the need for X-ray use in CT. The implications of X-ray use in CT was identified in further detail in 5 items for the following categories: time to diagnosis, treatment accuracy, patient comprehension and satisfaction, CT effects, and CT safety. Participants were asked to identify factors affecting CT intensity or specific techniques according to gender and age, severity of clinical symptoms, palpation and physical examination, degenerative changes of spine X-ray results, and degree of spinal malposition. Malposition diagnosis where X-rays were thought to be more significant than palpation or physical examination was also investigated. Most survey items were composed of 7-point Likert scales, and general items such as those on age and clinical experience were given as open-ended questions (Appendix 1).

Ethics, consent and permissions

This survey was approved by the Institutional Review Board of Jaseng Hospital of Korean Medicine (jaseng 2017-09-004).

Results

General characteristics of survey subjects

Gender and age

The overall response rate out of a total of 18,289 eligible subjects was 3.01% ($n = 552/18,289$). The participants consisted of 491

male (88.95%) and 61 female Korean medicine doctors (11.05%), 56 of the Korean medicine doctors were in their 20s (10.14%), 217 in their 30s (39.31%), 183 in their 40s (33.15%), 72 in their 50s (13.04%), 23 in their 60s (4.18%), and 1 was in their 70s (0.18%; Table 1).

Table 1. Demographic Characteristics of Survey Respondents.

| Factor | n (%) |
|--|------------------|
| Gender | 552 (100) |
| Male | 491 (88.95) |
| Female | 61 (11.05) |
| Age (y) | 40.47 \pm 9.22 |
| 20-30 | 50 (10.14) |
| 30-40 | 217 (39.31) |
| 40-50 | 183 (33.15) |
| 50-60 | 72 (13.04) |
| 60-70 | 23 (4.18) |
| \leq 70 | 1 (0.18) |
| Clinical experience (y) | 13.57 \pm 8.64 |
| <5 | 74 (13.41) |
| 5-10 | 132 (23.91) |
| 10-15 | 115 (20.83) |
| 15-20 | 112 (20.29) |
| 20-25 | 50 (9.06) |
| \leq 25 | 69 (12.5) |
| Level of affiliated medical institution | 552 (100) |
| Korean Medicine Clinic | 388 (70.29) |
| Korean Medicine Hospital | 86 (15.58) |
| General Hospital | 27 (4.89) |
| Convalescent Hospital | 23 (4.17) |
| Other | 28 (5.07) |
| Location of affiliated medical institution | 552 (100) |
| Seoul | 153 (27.77) |
| Busan | 33 (5.99) |
| Incheon | 24 (4.36) |
| Daegu | 18 (3.27) |
| Gwangju | 22 (3.99) |
| Daejeon | 22 (3.99) |
| Ulsan | 10 (1.81) |
| Gyeonggi | 121 (21.96) |
| Gangwon | 11 (2.00) |
| Chungcheong | 43 (7.80) |
| Jeolla | 41 (7.44) |
| Gyungsang | 45 (8.16) |
| Jeju | 2 (0.36) |
| Number of patients treated with Chuna/day | 552 (100) |
| <5 | 288 (52.17) |
| 5-10 | 111 (20.11) |
| 11-20 | 75 (13.59) |
| 21-30 | 42 (7.61) |
| 31-40 | 21 (3.80) |
| \leq 41 | 15 (2.72) |
| Proportion of Chuna patients with X-ray consultation (%) | 552 (100) |
| <10 | 263 (47.64) |
| 10-20 | 40 (7.25) |
| 20-30 | 52 (9.42) |
| \leq 30 | 197 (35.69) |

Clinical experience of Korean medicine practice

Of the 552 participants who replied to the survey, 74 Korean medicine doctors (13.41%) had <5 years of clinical experience, 132 had between 5-10 years (23.91%), 115 had 10-15 years (20.83%), 112 had 15-20 years (20.29%), 50 had 20-25 years (9.06%), and 69 had clinical experience of 25 years or more (12.5%; Table 1).

Level and location of currently affiliated medical institution

A total of 388 participants (70.29%) were affiliated to Korean medicine clinics; 86 (15.58%) to Korean medicine hospitals, 27 (4.89%) to university hospitals or general hospitals, 23 (4.17%) to long-term care hospitals, and 28 were affiliated to other institutions (5.07%).

The affiliated medical institution locations with the most participants were Seoul [153 participants (27.77%)], and Gyeonggi [121 participants (21.96%)], whilst the remaining locations had < 10% participants each (Table 1).

Average number of patients treated with Chuna/day

The average number of patients treated with CT per day for an affiliated medical institution that had < 5 patients was reported in 288 surveys (52.17%), 6-20 patients in 111 surveys (20.11%), 11-20 patients in 75 surveys (13.59%), 21-30 patients in 42 surveys (7.61%), 31-40 patients in 21 surveys (3.80%), and ≥ 41 patients was reported in 15 surveys (2.72%; Table 1).

Proportion of Chuna patients with X-ray consultation and its correlation with affiliation, and level of training regarding administration of clinical techniques for Chuna manual therapy

The proportion of patients who had received an X-ray consultation and CT, was < 10% as reported by 263 participants (47.64%), between 10-20% as reported by 40 participants (7.25%), 20-30% by 52 participants (9.42%), and ≥ 30% by 197 participants (35.69%; Table 1).

The results in this study showed that 56.70% of participants in Korean medicine clinics indicated that X-rays for treatment with CT was used in < 10% of cases. However, in Korean medicine hospitals/university hospitals/general hospitals, X-rays were more commonly used with CT (76.99% of participants reported X-rays being used with CT in 30% or more cases), as there were fewer participants (13.27%) who reported using X-rays with CT in < 10% of cases.

The majority of practitioners (55.14%) who treated < 10 patients with CT per day, considered X-rays for < 10% of cases, whilst the majority of practitioners (63.89%) who treated ≥ 31 patients with

CT per day, considered X-rays for ≥ 30% of cases. The number of patients the practitioners treat with CT per day correlated with the number of cases considered for X-rays (Table 2).

Regarding educational training for CT treatment, 305 (55.25%) participants answered that they had completed a CT education course(s), and 247 (44.75%) answered that they had not.

Implications of X-ray use and Chuna therapy treatment

Items regarding the implications of radiological diagnosis (X-ray) and use in treatment with CT administration were graded from 1 to 7. One point indicated 'very negative' and 7 points indicated 'very positive.' Answers of 6 and 7 points were categorized to indicate high importance/help, answers of 3, 4, and 5 indicated a moderate level of importance/help, and answers of 1 and 2 indicated a low level of importance/help.

A total of 435 participants (78.80%) answered that use of radiological diagnosis (X-ray) was very helpful in CT (6 or 7 points), 93 (16.85%) answered that it was moderately helpful (3, 4, or 5 points), and 24 (4.35%) answered that it was not helpful (1 or 2 points).

As shown in the results, a high percentage of participants answered that radiological imaging was beneficial for treatment with CT. In order to determine which aspects of radiological imaging were beneficial, 5 categories were considered: 1) time to diagnosis of malposition/dysfunction, 2) accuracy of CT, 3) patient comprehension and satisfaction, 4) CT effect, and 5) safety of CT.

Regarding time to diagnosis of malposition/dysfunction, 370 (67.03%) participants answered that X-ray imaging was very helpful (6 or 7 points), 154 (27.90%) reported that it was moderately helpful (3, 4, or 5 points), and 28 (5.07%) reported that it was not helpful (1 or 2 points). Regarding accuracy of CT, 393 (71.20%) participants answered that X-ray imaging was very helpful (6 or 7 points), 134 (24.28%) reported that it was moderately helpful (3, 4, or 5 points), and 25 (4.53%) that it was not helpful (1 or 2 points). Regarding patient comprehension and satisfaction, 460 (83.33%) participants answered that X-ray imaging was very helpful (6 or 7 points), 70 (12.68%) reported that it was moderately helpful (3, 4, or 5 points), and 22 (3.99%) that it was not helpful (1 or 2 points). Regarding CT effect, 292 (52.90%) participants answered that X-ray imaging was very helpful (6 or 7 points), 236 (42.75%) reported that it was moderately helpful (3, 4, or 5 points), and 24 (4.35%) that it was not helpful (1 or 2 points). Regarding safety of CT, 448 (81.16%) participants answered that X-ray imaging was very helpful (6 or 7 points), 84 (15.22%) reported that it was moderately helpful (3, 4, or 5 points),

Table 2. The Association Between Affiliated Institution and the Proportion of Patients Receiving Chuna therapy with an X-ray Consultation.

| | | Treatment with Chuna therapy and X-ray consultation (n, %) | | | | Total (n=552) |
|------------------------|---|--|-----------|------------|-------------|---------------|
| | | < 10% | 10-20% | 20-30% | ≤ 30% | |
| Affiliated institution | Korean medicine clinic | 220 (56.70) | 34 (8.76) | 40 (10.31) | 94 (24.23) | 388 |
| | Korean medicine hospital, general hospital, long-term care hospital or higher | 15 (13.27) | 3 (2.65) | 8 (7.08) | 87 (76.99) | 113 |
| | Other | 28 (54.90) | 3 (5.88) | 4 (7.84) | 16 (31.37) | 51 |
| Chuna patients/d | ≤ 10 | 220 (55.14) | 27 (6.77) | 38 (9.52) | 114 (28.57) | 399 |
| | 11-30 | 36 (30.77) | 11 (9.40) | 10 (8.55) | 60 (51.28) | 117 |
| | ≤ 31 | 7 (19.44) | 2 (5.56) | 4 (11.11) | 23 (63.89) | 36 |

and 20 (3.62%) that it was not helpful (1 or 2 points).

In an overall evaluation of the 5-item assessment of the importance/benefits of X-ray use in CT, items where X-ray use was reported to be the most important/helpful (highest frequency of 6 or 7-point answers) in descending order were patient comprehension and satisfaction (83.33%), safety of use (81.16%), accuracy (71.2%), time to diagnosis (67.03%), and efficacy (52.9%; Fig. 1).

Factors determining the intensity and specific technique of Chuna treatment

Determinant factors for selection of CT intensity and specific techniques were assessed. Regarding gender and age, a total of 358 participants (64.86%) answered that they are very important (6 or 7 points), 182 (32.97%) that they are moderately important (3, 4, or 5 points), and 12 (2.17%) that they are not important (1 or 2 points). Regarding severity of clinical symptoms, 384 (69.57%) answered that it is very important (6 or 7 points), 156 (28.26%) that it is moderately important (3, 4, or 5 points), and 12 (2.17%) that it is not important (1 or 2 points).

Regarding palpation and physical examination, 350 (63.41%)

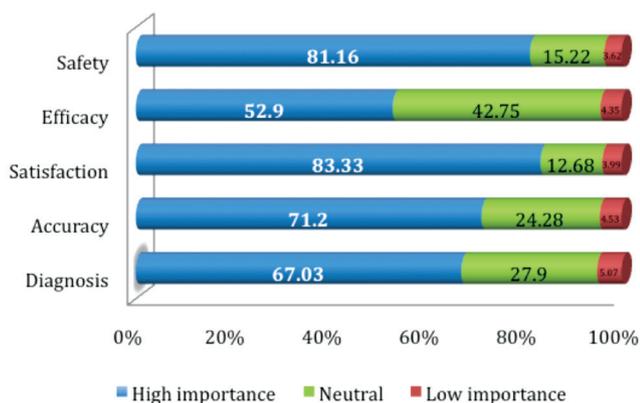


Fig. 1. The importance X-rays have in Chuna therapy. Seven-point Likert scales; Answers of 6 and 7 points were categorized to indicate high importance/help, answers of 3, 4, and 5 moderate importance/help, and answers of 1 and 2 low importance/help. The ratio of surveyees are presented as percentage.

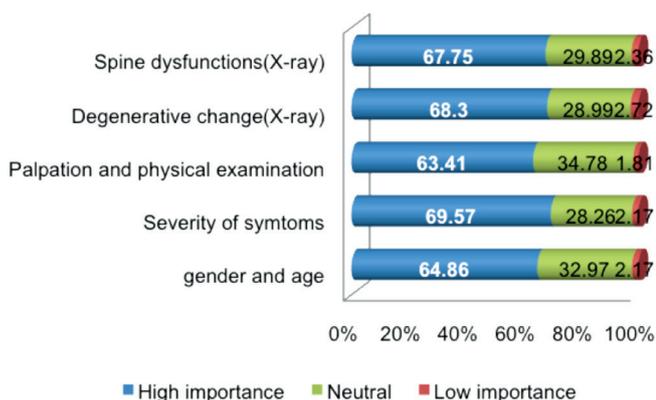


Fig. 2. Factors influencing selection of intensity and techniques of Chuna treatment. Seven-point Likert scales; Answers of 6 and 7 points were categorized to indicate high importance/help, answers of 3, 4, and 5 moderate importance/help, and answers of 1 and 2 low importance/help. The ratio of surveyees are presented as percentage.

answered that they are very important (6 or 7 points), 192 (34.78%) that they are moderately important (3, 4, or 5 points), and 10(1.81%) that they are not important (1 or 2 points). Regarding radiologic diagnosis (X-ray) results for degenerative changes of the spine (spurs and narrowing of intervertebral disc space), 377 (68.30%) answered that X-ray imaging is very important (6 or 7 points), 160 (28.99%) that it is moderately important (3, 4, or 5 points), and 15 (2.72%) that it is not important (1 or 2 points).

Regarding radiological diagnosis (X-ray) results for degree of spinal malposition, 374 (67.75%) answered that X-ray imaging is very important (6 or 7 points), 165 (29.89%) that it is moderately important (3, 4, or 5 points), and 13 (2.36%) that it is not important (1 or 2 points; Fig. 2).

The factor most influential in determining the intensity and specific technique of CT was severity of clinical symptoms (69.57%), but the results of radiological imaging for degenerative changes of the spine and degree of spinal malposition were also highly influential (68.3%).

Malposition diagnosis where radiological diagnosis (X-ray) was superior to palpation and physical examination

To assess for malposition diagnosis where radiological diagnosis (X-ray) was superior to palpation and physical examination, survey items were classified into 3 separate categories; spinal dysfunctions, iliac dysfunctions and sacral dysfunctions.

Concerning lumbar spine dysfunctions, 292 participants indicated spondylolisthesis (52.90%) was a condition where radiological diagnosis (X-ray) was superior to palpation and physical examination, 234 participants indicated rotational

Table 3. Dysfunctions Where X-ray Consultation was Regarded to Hold Higher Significance (Multiple Answers Allowed).

| Factor | n (%) |
|---------------------------------|-------------|
| Lumbar spine dysfunction | |
| Spondylolisthesis | 292 (52.90) |
| Side bending dysfunction | 251 (45.47) |
| Rotation dysfunction | 234 (42.39) |
| Retrolisthesis | 208 (37.68) |
| Combined dysfunction | 206 (37.32) |
| Flexion dysfunction | 200 (36.23) |
| Extension dysfunction | 158 (28.62) |
| Lateral displacement | 134 (24.28) |
| Iliac dysfunction | |
| Posterior rotation dysfunction | 149 (26.99) |
| Anterior rotation dysfunction | 142 (25.72) |
| Upslip | 139 (25.18) |
| Downslip | 135 (24.46) |
| Inflair | 129 (23.37) |
| Outflair | 127 (23.01) |
| Sacral dysfunction | |
| Rotation dysfunction | 142 (25.72) |
| Side bending dysfunction | 130 (23.55) |
| Flexion dysfunction | 111 (20.11) |
| Extension dysfunction | 97 (17.57) |

dysfunction (42.4%), and 251 participants indicated lateral bending dysfunction (45.47%) were dysfunctions where an X-ray is superior.

For iliac dysfunctions, 149 participants reported that posterior rotation dysfunction (26.99%) was a condition where X-ray was superior to palpation and physical examination, 142 participants indicated anterior rotation dysfunction (25.72%), and 139 participants indicated upslip (25.18%) were dysfunctions where an X-ray was superior.

For sacral dysfunctions, 142 participants indicated rotation dysfunction (25.72%) was a condition where X-ray diagnosis was superior to palpation and physical examination, 130 participants indicated lateral bending dysfunction (23.55%), and 111 participants reported flexion dysfunction (20.11%) as conditions where X-ray was superior to palpation and physical examination (Table 3).

Discussion

Chunamanual therapy is a Korean medicine treatment modality that is used for treatment of various musculoskeletal and nervous system disorders and its techniques can be applied to a wide range of clinical indications. It is known to be especially effective for pain related to spine and joint lesions, and peripheral and autonomic nervous system dysfunctions [7]. Use of CT is currently growing in Korean medicine and patient satisfaction has been reported to be high [7]. There have been various discussions to enhance the diagnostic accuracy of CT administration. In addition to the basic diagnostic tools of traditional Korean medicine, various conventional methods such as radiological imaging, orthopedic tests, neurological diagnosis, and physical examinations are also being employed [8].

Simple radiological imaging and the implications of X-ray use in CT administration was the main focus of this study. The opinions of Korean medicine doctors regarding determinant factors for specific CT techniques, treatment intensity, and which types of spinal malposition were indicated by X-ray use were assessed. The survey was distributed to a total of 18,289 eligible participants, of whom 562 participated in the survey study. The majority of participants (62.5%) were Korean medicine doctors in their 30s and 40s, and the majority of participants (65%) reported clinical experience of ≥ 5 years and < 20 years. Approximately 70% were affiliated with Korean medicine clinics, and 20% with Korean medicine hospitals, university hospitals, and general hospitals. Just over half of participants (52.17%) performed < 5 CT sessions per day, a third of survey participants (33.7%) conducted 6-20 CT sessions per day. Almost half the participants ($n = 263$) reported that they would use X-ray in $< 10\%$ of patients receiving CT. Of these practitioners when combined with the affiliated medical institutions, 56.70% worked at Korean medicine clinics and 13.27% worked at Korean medicine hospitals/university hospitals/general hospitals. Just over 3/4 (76.99%) of practitioners who worked at Korean medicine hospitals/university hospitals/general hospitals where X-rays are readily available through collaborative treatment, utilized X-rays for treatment in $> 30\%$ of CT cases. The results in this study indicate that practitioner affiliation and access to X-ray devices strongly determines whether X-rays are considered for treatment or not.

The survey showed that only 28.57% of practitioners who treated ≤ 10 patients receiving CT per day answered that they considered X-rays in $\geq 30\%$ of Chuna cases, and 51.28% of practitioners who treated 11-30 patients that received CT per day considered X-ray for $\geq 30\%$, while 63.89% of practitioners who treated ≥ 31 patients that received CT per day considered X-ray for $\geq 30\%$. It can be

inferred that higher frequency of CT is associated with greater consideration and utilization of X-ray imaging.

A total of 78.80% of participants answered that X-rays are beneficial in CT. Regarding which aspect for the use of X-ray is important/helpful (6 or 7 points), 83.33% replied enhancing patient comprehension and satisfaction, 71.20% replied that X-rays increase the accuracy of CT, and 67.03% replied that they save time in malposition diagnosis. About half of survey participants (52.9%) answered that X-rays increase treatment effectiveness of CT, and a higher percentage (81.16%) answered that X-rays heighten CT safety. These 5 items were reordered by order of highest frequency of importance/help as follows: patient comprehension and satisfaction, safety, accuracy, time to diagnosis, and treatment effect. In the opinion of Korean medicine doctors, use of X-ray is especially beneficial in enhancing patient comprehension and satisfaction and increasing safety of CT administration.

Regarding determinant factors for selection of CT intensity and techniques, 64.86% of participants replied that gender and age are very important (6 or 7 points), 69.57% replied that severity of clinical symptoms is very important (6 or 7 points), 63.41% replied that palpation and physical examination are very important (6 or 7 points), and 68.30% and 67.75% respectively replied that radiological diagnosis, X-ray results regarding degenerative changes of the spine and degree of spinal malposition are very important (6 or 7 points). The above-mentioned items were all reported to highly influence the intensity and technique of CT, of which the severity of clinical symptoms and radiological diagnosis results were most widely regarded to be influential. The Dysfunction/Malposition diagnosis type where radiological diagnosis (X-ray) was construed to be more beneficial than palpation and physical examination was anterior dysfunction (52.9%), followed closely by iliac and sacral dysfunctions with little difference in percentage.

However, as only 3% (552) of Korean medicine doctors participated in this study, this may not be fully representative. Since the survey was distributed by e-mail, many potential participants in their 60s or 70s with low accessibility to e-mails or the internet may have been inadvertently excluded from the survey. In addition, more than half of the survey participants were Korean medicine doctors who treated < 5 patients with CT per day. This low rate of CT administration by the participants further adds to the question of whether the study was representative. Almost half of the participants (47.64%) reported that they had X-rays in $< 10\%$ of CT cases, which may have been due to the lack of access to X-rays in their clinical setting. CT is not covered by Korean national health insurance yet, and not all Korean medicine facilities have access to X-ray machines, so most patients do not expect to receive X-ray examinations at Korean medicine clinics. This was apparent in this study where practitioners affiliated with Korean medicine clinics with limited access to X-ray facilities, used X-rays less than practitioners who work at Korean medicine hospitals/university hospitals/general hospitals. These results suggest that if more Korean medicine clinics had access to X-rays, more Korean medicine doctors would choose to use them. Korean national health insurance is set to cover CT in the near future so the prediction is for an increased requirement for X-rays with CT. Increased availability of X-rays is expected to contribute to raised levels of patient safety and patient satisfaction of CT.

This study is the first study to investigate the opinions of Korean medicine doctors regarding the use of X-rays with administration of CT. In conclusion, 78.80% of Korean medicine doctors replied that utilizing X-rays for CT adds significant value, and 83.33% said that X-rays were helpful in enhancing patient comprehension and satisfaction for administration of CT, with 81.16% considering the use of X-rays beneficial in helping to increase safety of CT

administration. Although it is rare for CT to be associated with adverse effects, there are reports of serious adverse events, Lee et al [9] has reported such cases implicated with administration of CT, but these were mostly attributed to the administration of CT by non-specialized practitioners. As reports of severe adverse effects relating to CT exist, albeit rare, increasing safety in CT should prove beneficial to both patients and practitioners (Korean medicine doctors). Based on the results of this survey, it can be concluded that use of X-rays in CT administration not only increases patient comprehension and satisfaction, but also may improve safety. While this study focused on the use of X-rays, future studies may consider other radiological and diagnostic imaging devices to further identify benefits in clinical practice.

Conflicts of Interests

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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Appendix 1.

Survey on X-ray use for administration of Chuna manual therapy

Hello.

This survey is part of a basic survey study conducted to the aim of developing methodology towards building an evidence base for clinical effectiveness of Korean medicine treatment modalities through use of quantitative diagnostic medical devices in clinical settings. Chuna manual therapy is a Korean medicine treatment method that adjusts not only skeletal alignment, but also joints and ligaments, and promotes circulation of the meridians and Qi and Blood, and as such is used extensively for musculoskeletal disorders. In addition, X-rays are the most widely used and cost-effective diagnostic tool for imaging the skeletal structure and allows close examination of the skeletal alignment and physical landmarks.

Jaseng Medical Foundation is in the process of conducting a study for protocol development of an observational study that will collect clinical treatment data to strengthen treatment effects and enhance patient safety in treatment of musculoskeletal disorders using Chuna manual therapy as part of an academic research study project service task funded by a grant from the Korea Institute of Oriental Medicine.

We appreciate the time and effort taken to participate in this survey. We ask that you contribute to this survey to heighten the utility and value of this study through incorporation of your opinions and experience in use of X-rays in Chuna treatment.

Responses will remain strictly confidential in accordance with Article 33 (Protection of Secrets) and 34 (Responsibility of Statistics Workers) of the Statistics Act, and will be used in statistical analysis for study design purposes only. Thank you for your cooperation.

September 2017

Jaseng Spine and Joint Research Institute, Jaseng Medical Foundation

■ General characteristics

1. Please specify your gender.

Male Female

2. Please indicate your age according to the international age system.

_____ years

2. How many full years of clinical experience have you had since obtaining a Korean medicine doctor's license (including years of residency, and service as public health doctor or army medical officer)?

_____ years

3. Under what category is your affiliated institution classified?

- Korean medicine clinic
 Korean medicine hospital
 University hospital, general hospital, or higher
 Long-term care hospital
 Other

4. Where is your affiliated institution located?

- Seoul
 Busan
 Incheon
 Daegu
 Gwangju
 Daejeon
 Ulsan
 Sejong
 Gyeonggi-do
 Gangwon-do
 Chungcheongbuk-do
 Chungcheongnam-do

- Jeollabuk-do
- Jeollanam-do
- Gyungsoangbuk-do
- Gyungsoangnam-do
- Jeju

5. How many patients do you treat with Chuna manual therapy on average per day?

- <5 patients
- 5-10 patients
- 11-20 patients
- 21-30 patients
- 31-40 patients
- ≥41 patients

6. What is the average percentage (%) of patients that you check for test results for treatment means through consultation for radiologic diagnosis (X-ray) or patient visits with radiologic diagnosis results out of total Chuna patients?

- ≤10%
- 11-20%
- 21-30%
- 31-100%

7. Have you participated in or completed Chuna education course(s) at the Chuna Medicine Academy (provided by the Korean Society of Chuna Manual Medicine for Spine & Nerves)?

- Yes
- No

■ Use of radiologic diagnosis (X-ray) in administration of Chuna manual therapy

1. Do you regard use of radiologic diagnosis (X-ray) to be beneficial in administration of Chuna manual therapy?

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

2. For what aspect do you regard use of radiologic diagnosis (X-ray) to be beneficial in administration of Chuna manual therapy?

1) Saving time to diagnosis of malposition/dysfunction for Chuna treatment

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

2) Increased accuracy of Chuna treatment

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

3) Increased patient comprehension and satisfaction of Chuna treatment

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

4) Increased Chuna treatment effect

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

5) Increased safety of Chuna treatment

| ← Low importance/help | Neutral | | | High importance/help | | |
|-----------------------|---------|---|---|----------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

6) Please give us your opinion freely on additional aspects where use of radiologic diagnosis is beneficial in administration of Chuna manual therapy.

3. How much do the following factors affect selection of Chuna treatment intensity and specific techniques?

1) Sex and age

| ← Low association | Neutral | | | High association → | | |
|-------------------|---------|---|---|--------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

2) Severity of clinical symptoms

| ← Low association | Neutral | | | High association → | | |
|-------------------|---------|---|---|--------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

3) Palpation and physical examination

| ← Low association | Neutral | | | High association → | | |
|-------------------|---------|---|---|--------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

4) Radiologic diagnosis (X-ray) results for degenerative changes of the spine (spurs and narrowing of intervertebral disc space)

| ← Low association | Neutral | | | High association → | | |
|-------------------|---------|---|---|--------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

5) Regarding radiologic diagnosis (X-ray) results for degree of spinal malposition

| ← Low association | Neutral | | | High association → | | |
|-------------------|---------|---|---|--------------------|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

4. For which spine or pelvic malposition diagnoses is radiologic diagnosis (X-ray) superior to palpation and physical examination clinically? (multiple answers allowed)

Lumbar spine dysfunctions:

- ① Flexion dysfunction, ② Extension dysfunction, ③ Side bending dysfunction,
- ④ Rotation dysfunction, ⑤ Spondylolisthesis, ⑥ Retrolisthesis, ⑦ Lateral displacement,
- ⑧ Combined dysfunction

Iliac dysfunctions:

- ⑨ Inflair, ⑩ Outflair, ⑪ Anterior rotation dysfunction, ⑫ Posterior rotation dysfunction,
- ⑬ Upslip, ⑭ Downslip

Sacral dysfunctions:

- ⑮ Flexion dysfunction, ⑯ Extension dysfunction, ⑰ Side bending dysfunction,
- ⑱ Rotation dysfunction