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Original Article

A cross-sectional survey of clinical factors that influence the use of traditional Korean medicine among children with cerebral palsy



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ABSTRACT

Background: Traditional Korean medicine (TKM) is widely used to treat children with cerebral palsy (CP) in Korea; however, studies investigating factors that influence the use of TKM are scarce. Thus, we investigated the clinical factors that might influence the use of TKM.

Methods: A population-based, cross-sectional, multicenter survey was performed from August 2014 to May 2016. The history of TKM use, type and severity of CP, current treatment characteristics, presence of accompanying disabilities or other health problems not directly related to CP, and monthly cost for the treatment of CP were surveyed.

Results: In total, 182 children were recruited, and 78 children (42.9%) had used TKM. Among these 78 children, 50 (64.1% of the TKM-use group) had used both acupuncture and herbal medication, 15 (19.2%) had used acupuncture only, and 13 (16.7%) had used herbal medication only. Children with non-typical CP, accompanying disabilities and general health problems tended to use TKM. The monthly cost of treatment for CP was significantly higher in the TKM-use group than that in the no-TKM-use group, suggesting that economically disadvantaged children may have difficulty in accessing TKM. Dietary supplements, conventional pharmacological treatments, and rehabilitation therapies did not affect TKM use.

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Conclusion: Children with non-typical symptoms or those with poor overall health status are likely to use TKM. Additionally, TKM use leads to increased treatment costs. Studies investigating the motivation for starting or ceasing TKM therapy, socioeconomic factors and the attitude of parents towards complementary and alternative medicine should be performed.

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1. Introduction

Cerebral palsy (CP) is a group of non-progressive disorders caused by disturbances in the developing fetal or infant brain that affect the development of movement and posture.¹ The global prevalence of CP is 2.11 per 1000 births.² In South Korea, the prevalence is 2.6 per 1000 births, and patients with CP incur 1.8-fold more medical expenses than the general population.³ CP involves disorders of cognition, learning, communication, behavior, and movement.⁴ Therefore, a comprehensive and multidisciplinary approach is necessary. Adequate treatment depends on the region and size of neurological damage, patient age, and other factors.⁵

South Korea follows a dual medical system divided into conventional Western medicine and traditional Korean medicine (TKM). TKM has a shared origin with traditional Chinese medicine (TCM); however, TKM has undergone intrinsic development and has distinctive characteristics from TCM^{6,7} that make TKM both similar to and different from TCM. Acupuncture and herbal medication are the treatment tools most commonly used in TKM and TCM and are performed globally as one form of complementary and alternative medicine (CAM).

TKM is widely used for various pediatric diseases in South Korea; for example, 65.2% to 67.8% of elementary school-age children have used herbal TKM,^{6,8} as have 17.2% of children with epilepsy.⁹ Some children with neurological diseases, including CP, undergo concurrent TKM and conventional treatment.¹⁰ Among children with neuropsychiatric diseases including CP, 35.4% of them have used herbal medication, 15.5% have used acupuncture or moxibustion and 0.5% have used Chuna or massage; the current utilization rate is 4% for herbal medication and 2.1% for acupuncture or moxibustion.¹⁰ In previous studies on the use of CAM for CP, therapeutic effects of acupuncture, Chuna and herbal medication on physical and cognitive functions have been reported,^{11,12} and acupuncture has been shown to increase brain plasticity.¹³ In addition, it has been reported that the utilization rate of CAM is higher in children with CP than that in children with other neuropsychiatric diseases.^{14,15}

As CAM or TKM is widely used for CP, more reliable studies, such as randomized controlled trials (RCTs), are needed to evaluate the effectiveness and safety of these modalities. Basic information, including utilization situation and possible responders, is needed. According to previous studies on the use of CAM among children with CP, children used CAM more frequently when their parents used CAM^{15–17} or when their parents' education level or socioeconomic status (SES)

was relatively high.^{17,18} These studies primarily focused on the family's SES or attitude towards CAM. Some studies have investigated factors related to the children's condition, such as the inability to walk independently,¹⁶ presence of seizures¹⁸ or young age¹⁶; however, studies investigating the specific features of CP itself are scarce.

Therefore, we designed a survey investigating clinical factors that influence the use of TKM. Using a cross-sectional survey, we examined the history of TKM use, type and severity of CP, common accompanying disabilities and other problems related to overall health condition and attempted to determine the possible clinical factors that influence TKM use.

2. Method

2.1. Study design

This study is a population-based, cross-sectional, multicenter survey examining clinical factors that might influence TKM use in children with CP. This study was approved by the institutional review board (IRB) of Pusan National University Hospital (H1404-022-017).

2.2. Setting

This cross-sectional study recruited children with CP from two university-affiliated hospitals, one TKM hospital, and three TKM clinics (Seoul, Pusan, Daegu, Ulsan, and Yangsan-si) from August 2014 to May 2016.

2.3. Participants

To be eligible, the children had to be diagnosed with CP either finally or provisionally, to be between 6 and 78 months of age, to be currently treated with conventional rehabilitation therapy (RT) and to have guardians who consented to their participation in this study. The age range was defined to include children younger than school age because there is a limit on the amount of time children can visit hospitals after being enrolled in a school, and children receive RT most actively prior to enrollment in school. Children with congenital muscular diseases, genetic disorders, or progressive central nervous system disorders were excluded; we also excluded children who were currently undergoing treatment for other severe diseases, such as tumors, cardiac diseases, or severe infection. RT was defined as physical therapy, occupational therapy, speech therapy, hydrotherapy, or other treatments corresponding to conventional Western medicine. Recruitment was performed

by distributing and posting an announcement, thereby offering an equal enrollment opportunity to eligible children and reducing selection bias.

2.4. Variables

Age; sex; height; weight; accompanying disabilities, including cognitive impairment, seizure, dysphagia, deficiencies in vision, hearing or language, or musculoskeletal deformation; and other health problems not directly related to CP were recorded. Other health problems included constipation, sputum production, sleep disorders, atopic dermatitis, allergic rhinitis, asthma, anorexia, dyspepsia, growth retardation, enuresis, and frequent upper respiratory infection. The possible clinical factors recorded included the type of CP, the frequency of RT, and the type of treatment (botulinum toxin treatment; assist device use, including upper or lower limb orthoses and wheelchairs; medication; and dietary supplements). Disease severity was evaluated using the Gross Motor Function Classification System (GMFCS).¹⁹

We defined TKM as traditional Korean herbal medication or acupuncture performed by a licensed TKM doctor. The TKM-use group included children who had used TKM for the treatment of CP after being diagnosed with CP. The no-TKM-use group included children who had never used TKM. We did not directly inquire about items that can be used to evaluate the SES, such as educational level and monthly income, but instead investigated the monthly costs for the use of RT, TKM and dietary supplements.

2.5. Data source/measurement

A pediatric physical therapist with over 5 years of experience in pediatric RT who was not directly involved in the children's treatment but was dedicated to the evaluation of the research identified the type of CP and classified each child according to the GMFCS. The GMFCS was used to assess disease severity in the children, and we categorized the children into a mild-to-moderate grade (grades 1 to 3) group and a severe grade (grades 4 and 5) group.

Parents or guardians were asked to answer questionnaires about the medical history, accompanying disabilities, health problems, and use of medication, health supplements, RT, and TKM. After the parents or guardians completed the forms, the physical therapist ensured there were no unanswered questions. One physical therapist visited all the participating institutions and evaluated all the children.

2.6. Statistical analysis

The values for the general and clinical factors are summarized as the mean \pm standard deviation for continuous data and frequencies and percentages for categorical data. To determine statistically significant differences between groups, we performed independent t-tests or Wilcoxon's signed rank sum test (t-approximation) for continuous data and the chi-square (correction for continuity) or Fisher exact test for categorical data. Statistical significance was set below 0.05, and SAS 9.4 software (SAS Institute Inc., Cary, NC, USA, 2013) was used for all statistical analyses.

3. Results

We distributed the questionnaire to 207 participants who had submitted written consent and 187 responded (response rate of 90.3%). The data from 182 participants were analyzed after excluding the data for one participant who did not meet the age criteria and four participants who did not undergo GMFCS evaluation.

3.1. General condition

Among the 182 children, 42.9% had used TKM ($n=78$), while 57.1% had not used TKM ($n=104$). Out of the 78 children in the TKM-use group, 64.1% had used both acupuncture and herbal TKM ($n=50$), 19.2% had used only acupuncture ($n=15$), and 16.7% had used only herbal medication ($n=13$).

The TKM-use group was older in age than the no-TKM-use group (approximately 39.4 months and 31.8 months, respectively; $p=0.011$), and the height was greater in the TKM-use group than in the no-TKM-use group (91.2 cm and 87.5 cm, respectively; $p=0.040$); however, body weight was similar between the two groups (12.4 kg and 12.2 kg, respectively; $p=0.514$).

The percentage of children with accompanying disabilities was 80.8% in the TKM-use group and 66.4% in the no-TKM-use group ($p=0.047$), and the mean number of accompanying disabilities was greater in the TKM-use group than in the no-TKM-use group (1.8 ± 1.4 and 1.4 ± 1.3 , respectively, $p=0.026$).

The TKM-use group also included more children with other health problems than the no-TKM-use group (62.8% and 38.5%, respectively; $p=0.002$). The mean number of other health problems was also higher in the TKM-use group than in the no-TKM-use group (1.2 ± 1.3 and 0.7 ± 1.1 , respectively; $p=0.002$) (Table 1).

3.2. Type and severity of CP

When roughly categorized into the spastic and non-spastic types of CP, the TKM-use group included fewer cases of spastic-type CP than the no-TKM-use group (55.1% and 76.9%, respectively; $p=0.002$). A more detailed analysis revealed that spastic type CP was the most common type in both the TKM-use and no-TKM-use groups; the next most common type was not clear (18.0% and 11.5%, respectively), followed by atonic-type CP (12.8% and 4.8%, respectively). There was a significant difference in the percentage of children with different types of CP between the groups ($p=0.023$).

In terms of disease severity according to the GMFCS, the TKM-use group included more children with 'severe CP' than the no-TKM-use group, but this difference was not statistically significant (47.4% and 36.5%, respectively; $p=0.185$). Of the five GMFCS grades, Grade 5 accounted for the largest percentage of cases in the TKM-use group (30.8%), whereas Grade 1 accounted for the largest percentage of cases in the no-TKM-use group (41.4%) ($p=0.156$).

The prevalence of seizure was higher in the TKM-use group than in the no-TKM-use group (26.9% and 13.5%, respectively, $p=0.037$) (Table 2).

Table 1 – General characteristics of participants

Variable	TKM-use (N = 78)	No-TKM-use (N = 104)	p-Value
Sex			
Male	53 (68.0%)	62 (59.6%)	0.249 ^a
Female	25 (32.1%)	42 (40.4%)	
Age (mos.)	39.4 ± 20.1	31.8 ± 17.8	0.011 ^{b,*}
Height (cm)	91.2 ± 12.1	87.5 ± 11.4	0.040 ^{c,*}
Weight (kg)	12.4 ± 3.4	12.2 ± 3.6	0.514 ^b
Accompanying disabilities			
No	15 (19.2%)	35 (33.7%)	0.031 ^{a,*}
Yes	63 (80.8%)	69 (66.4%)	
Number of accompanying disabilities	1.8 ± 1.4	1.4 ± 1.3	0.026 ^{b,*}
Other health problems			
No	29 (37.2%)	64 (61.5%)	0.001 ^{a,*}
Yes	49 (62.8%)	40 (38.5%)	
Number of other health problems	1.2 ± 1.3	0.7 ± 1.1	0.002 ^{b,*}
TKM, traditional Korean medicine.			
^a Chi-square test.			
^b Wilcoxon rank sum test.			
^c Independent t-test.			
* Statistically significant ($p < 0.05$).			

Table 2 – Type and severity of cerebral palsy

Variable	TKM-use (N = 78)	No-TKM-use (N = 104)	p-Value
Type of CP			
Spastic (N = 123)	43 (55.1%)	80 (76.9%)	0.002 ^{a,*}
Non-spastic (N = 59)	35 (44.9%)	24 (23.1%)	
Type of CP (Detail)			
Spastic	43 (55.1%)	80 (76.9%)	0.023 ^{b,*}
Ataxic	4 (5.1%)	4 (3.9%)	
Atonic	10 (12.8%)	5 (4.8%)	
Mixed	7 (9.0%)	3 (2.9%)	
Not clear	14 (18.0%)	12 (11.5%)	
GMFCS			
Mild-to-moderate (Gr. 1–3) (N = 107)	41 (52.6%)	66 (63.5%)	0.139 ^a
Severe (Gr. 4–5) (N = 75)	37 (47.4%)	38 (36.5%)	
GMFCS (Detail)			
Grade 1	19 (24.4%)	43 (41.4%)	0.156 ^a
Grade 2	8 (10.3%)	7 (6.7%)	
Grade 3	14 (18.0%)	16 (15.4%)	
Grade 4	13 (16.7%)	17 (16.4%)	
Grade 5	24 (30.8%)	21 (20.2%)	
Prevalence of seizure (N = 35)	21(26.9%)	14 (13.5%)	0.023 ^{a,*}
TKM, traditional Korean medicine; CP, cerebral palsy; GMFCS, Gross Motor Function Classification System.			
^a Chi-square test.			
^b Fisher's exact test.			
* Statistically significant ($p < 0.05$).			

3.3. Treatments

The age at treatment initiation was similar between the TKM-use group and the no-TKM-use group (9.4 months and 9.9 months, respectively). The number of RTs per week was also similar between the groups (12.2 ± 8.1 and 11.0 ± 8.0 , respectively; $p = 0.277$).

Regarding the treatment method, the proportion of children who had received botulinum toxin treatment (25.0% and 18.0%, respectively) and the proportion of those who were using dietary supplements (68.3% and 57.7%, respectively)

were higher in the no-TKM-use group than in the TKM-use group, but the differences were not statistically significant. The proportion of children who were using assist devices (65.4% and 55.8%, respectively) and pharmacologic treatment (34.6% and 26.0%, respectively) was higher in the TKM-use group than in the no-TKM-use group, but the differences were not statistically significant (Table 3).

The monthly cost of the treatment for CP was significantly different between the two groups, with 772.7 ± 422.0 US dollars in the TKM-use group, and 464.5 ± 552.3 US dollars in the no-TKM-use group ($p < 0.0001$).

Table 3 – Treatment characteristics

Variable	TKM-use (N = 78)	No-TKM-use (N = 104)	p-Value
Age of starting treatment (mos.)	9.4 ± 7.9	9.9 ± 9.2	0.674 ^b
Present RT use per week [†]	12.2 ± 8.1	11.0 ± 8.0	0.277 ^b
Botulinum toxin use			
No (N = 142)	64 (82.1%)	78 (75.0%)	0.255 ^a
Yes (N = 40)	14 (18.0%)	26 (25.0%)	
Present assist device use [†]			
No (N = 73)	27 (34.6%)	46 (44.2%)	0.190 ^a
Yes (N = 109)	51 (65.4%)	58 (55.8%)	
Present pharmacologic treatment [†]			
No (N = 128)	51 (65.4%)	77 (74.0%)	0.206 ^a
Yes (N = 54)	27 (34.6%)	27 (26.0%)	
Present dietary supplement use			
No (N = 66)	33 (42.3%)	33 (31.7%)	0.142 ^a
Yes (N = 116)	45 (57.7%)	71 (68.3%)	
Monthly cost for treatment (US dollars) [‡]	773.2 ± 421.4	464.5 ± 552.3	<0.0001 ^{b,*}

TKM, traditional Korean medicine; RT, rehabilitation therapy.

^a Chi-square test.

^b Wilcoxon rank sum test.

* Statistically significant ($p < 0.05$).

[†] Present use.

[‡] 1 US dollar = 1132.50 Korean Won.

4. Discussion

Based on the survey of 182 children with CP (42.9% in the TKM-use group and 57.1% in the no-TKM-use group), several potential factors influencing the use of TKM were identified. Children who had non-spastic type CP, accompanying disabilities or other health problems used TKM more often than children who did not. In addition, children who had severe CP according to the GMFCS tended to use TKM; however, the difference was not statistically significant. Considering the increased monthly costs for the treatment of CP, TKM may have been implemented when the families could afford the additional costs. Pharmacological treatments, dietary supplements, and frequency of RT did not influence TKM use.

The present study focused on clinical features that are important for CP. The overall health status and treatment status were also surveyed to determine factors that influence the use of TKM in children with CP. However, our study has some limitations in that the medical history was obtained from the parents' recollection, resulting in a potential risk of recall bias. Secondly, the subjects of this study were not representative of the broader CP population in Korea because the participating institutions did not include conventional primary care clinics and because of the small number of institutions surveyed, with 3 hospitals and 3 TKM clinics. In addition, we restricted the study population to children aged between 6 and 78 months, and the results may thus not be applicable to all children with CP. In contrast, the results still have significance, as they provide information on a specific group with a great demand for TKM by excluding school-age children.

The reported TKM utilization rate (42.9%) in this study may be higher than the actual rate in the broader CP population because survey respondents were recruited from TKM institutions. Of the 182 enrolled children, 148 were enrolled at conventional Western medical institutions, and 31.8% ($n = 47$)

of these children used TKM, which is probably closer to the actual TKM utilization rate among children with CP aged between 6 and 78 months in South Korea. A Korean study conducted at conventional university hospitals and community relief centers in 2004 indicated that 25.3% of the patients had used acupuncture and that 20.1% had used herbal medication.²⁰ In our study, 65 children (35.7% of the included 182 participants) had used acupuncture, and 63 children (34.6% of the included 182 participants) had used herbal medication. Our study showed a higher proportion of children using TKM than expected, likely because we recruited from TKM institutions. A 2013 study on children with developmental disorders revealed that the utilization rate of acupuncture or moxibustion and herbal medication was 11% and 13%, respectively.²¹ The differences in the CAM utilization rate may depend on the property of the disease, as shown by previous studies indicating that the utilization rate of CAM for CP was somewhat higher than that for other diseases.^{14,15} Although no comparable studies are available for China or Japan, the rate of TKM use in young CP patients is significantly higher in South Korea than in Western countries. The respective utilization rates of acupuncture and chiropractic treatment were 1.4% and 6.6% among children with CP aged 0–18 years in the United States of America (USA).¹⁶ In Canada, the utilization rate per year was 0.8% for acupuncture, 3.6% for herbal medication, and 2.4% for chiropractic treatment among children with CP aged 11.5–20.5 years.²² A United Kingdom (UK) study on moderate-to-severe CP in children aged 5–12 years reported a 3.1% utilization rate for acupuncture and 3.1% for herbal medicine, but the study had a small sample size ($n = 32$).¹⁸ These discrepancies probably resulted from intellectual or cultural differences²² along with policy support for these modalities and their integration in society. In addition, age differences likely underlie these discrepancies because our study included relatively young children, whereas previous studies included children up to 20.5 years

of age. Early RT is known to be important because of neural plasticity,²³ and younger children tend to receive more treatments.³

We also investigated the clinical factors that influence TKM use. Children who had non-spastic type CP or accompanying disabilities used TKM more often than children who did not. In addition, children who had severe CP according to the GMFCS and children who experienced seizure tended to use TKM. Regarding the types of CP, Hong²⁰ reported that children with non-spastic type CP had a higher utilization rate of TKM than children with spastic-type CP, which is consistent with our results. In addition, non-spastic type CP is not a typical type of CP; thus, our results might also indicate that children used TKM more often when the diagnosis of the disease was delayed.²⁰ Regarding disease severity, our findings indicate that children with more severe CP used TKM at a higher rate than those with mild CP. These results correspond with those of previous studies reporting that when the disease is more severe, including disease with high GMFCS grades, the use of CAM is more common.^{14,16,20,22} In addition, a previous study revealed that children with more-severe motor dysfunction used rehabilitation therapies at a higher rate than those with less-severe motor dysfunction.²⁴ Accordingly, the use of TKM is clearly increased in serious diseases along with conventional medicine, as the use of therapies in general increases with the severity of the disease. Wray et al¹⁸ reported that children who did not experience seizure tended to use CAM, which contrasts with our results showing a higher proportion of children with seizure in the TKM-use group than in the no-TKM-use group. The reasons for this difference could not be determined in the present study, but previous studies have revealed that children who experience seizure use TKM relatively frequently in South Korea⁹ and that resistant childhood epilepsy is often treated with herbal medication.²⁵ Children who had other health problems used TKM more often than children without other health issues. In addition, increased height and body weight were expected due to the 8-month greater mean age in the TKM-use group than in the no-TKM-use group, but the body weight was not consistent with the average age and height. The body weight of the TKM-use group was relatively less than expected compared with the normal development chart of Korea based on age and height.²⁶ This result may imply that the TKM-use group included more children with poor health conditions. Jeong et al²⁷ reported that children with neuropsychiatric diseases who have other health problems use CAM more often than children who do not have other health problems. In addition, TKM has been used to improve physical strength, and children with disabilities in South Korea often have physical weakness,²⁸ nocturnal enuresis,²⁹ and emotional and behavioral disorders³⁰ as well as high rates of common infectious diseases.³¹

With respect to treatment types, pharmacologic treatment, dietary supplements and frequency of RT did not influence TKM use. We expected the proportion of children using dietary supplements to be reduced in the TKM-use group because a previous study in South Korea reported dietary supplements as substitutions for herbal TKM³²; however, our results indicated that dietary supplements were complementary rather than an alternative to conventional medicine, at least in young children with CP in South Korea. Additionally,

we expected the frequency of RT to be reduced in the TKM-use group, but this was not the case. Children in the TKM-use group did not appear to avoid conventional therapies. This result implies that children in the TKM-use group likely make additional hospital visits and try as many treatments as possible to achieve any potential benefit. A similar result was observed for CAM, which is used to complement conventional medicine rather than to replace dissatisfactory conventional medicine in CP.¹⁴ Previous studies have reported that many patients do not inform their physicians about their use of traditional medicine or other CAM treatments^{33,34}; thus, appropriate measures are needed for the patients seeking to receive many treatments. Accordingly, the patients' monthly total cost for the treatment of CP was higher in the TKM-use group than in the no-TKM-use group (773.2 ± 421.4 and 464.5 ± 552.3 US dollars, respectively), and the monthly cost for TKM among 38 children who were receiving TKM therapy at the time of the interview was 441.7 ± 343.3 US dollars. This finding shows that the 'additional cost' required for TKM is considerable. The higher additional costs might be influenced by the condition of the children in the TKM-use group, which included children with more severe CP, more accompanying disabilities, and a higher prevalence of other health problems, and by the fact that herbal medication is an expensive treatment not covered by the national health insurance system, resulting in relatively high additional costs. These results suggest that children with low SES may have difficulty accessing TKM due to financial reasons.

To validate these observations, studies investigating the motivation for starting or ceasing TKM therapy, socioeconomic factors and the attitude of parents towards CAM should be performed. The findings of this study will help us understand objective clinical factors that influence TKM or CAM use to determine the specific needs of CP patients and to provide optimum treatments according to disease features. The effectiveness and safety of TKM therapy should thus be evaluated in a well-designed clinical study.

In conclusion, we surveyed the use of TKM among children with CP aged between 6 and 78 months in South Korea and compared the clinical features of the TKM-use group and no-TKM-use group. Non-spastic type CP, increased disease severity, and the presence of accompanying disabilities such as epilepsy or other health problems are more frequent in children who use TKM than in children who do not. Additionally, TKM use is not affected by pharmacological treatments, dietary supplements or frequency of RT. It is presumed that TKM is used when the increased cost of treatment can be tolerated.

Ethics approval and consent for participation and publication

This study was approved by the IRB of Pusan National University Hospital (H1404-022-017). This study was conducted with respect for the individual participants according to the Declaration of Helsinki, the Ethical Guidelines for Korea Good Clinical Practice, and relevant laws and regulations. All participants submitted written consent indicating their willingness to participate.

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Conflict of interest

The authors declare no conflict of interest.

Data sharing

Further study data are available from the corresponding author upon request.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.imr.2018.07.001>.

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