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Clinical outcomes and cost-effectiveness of collaborative treatment with Korean and Western medicine in patients with facial palsy: a multicenter prospective observational study

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Abstract

Background Effective and cost-efficient treatment approaches are crucial in healthcare to optimize patient outcomes. This study evaluates and compares the clinical outcomes and cost-effectiveness of Korean and Western medicine collaborative treatment (CT) with usual care (UC) for patients with facial palsy (FP).

Methods A two-arm comparative, multicenter, prospective, observational study was conducted at 11 nationwide hospitals participating in the fourth phase of the national pilot project for CT. A total of 130 FP patients were enrolled at baseline, with follow-up assessments at 4 weeks and 12 weeks post-baseline. Clinical outcomes were evaluated using the House-Brackmann Grading Scale (HBGS), Numeric Rating Scale (NRS), EuroQol-5 Dimensions (EQ-5D-5L), and EuroQol-Visual Analogue Scale (EQ-VAS) at all three time points of the study. The cost-effectiveness evaluation was assessed using Cost per QALYs (Quality-Adjusted Life Years), Incremental Cost-Effectiveness Ratio (ICER), and Net Monetary Benefit (NMB).

Results The mean HBGS, NRS and EQ-VAS scores significantly improved in both groups over time (each, $p < 0.05$). Compared to UC, CT demonstrated significantly higher EQ-5D-5L scores (0.94 ± 0.11 vs. 0.91 ± 0.13), and this effect remained significant even after adjusting for age, sex, duration, and income level ($\beta = 0.06$, $p < 0.05$). From a limited societal perspective, the total cost difference between the two groups was not statistically significant; however, the QALYs gained were significantly higher in patients who received CT than those who received UC (0.010 QALYs vs. 0.008 QALYs). The ICER for CT was estimated at 28.1 million Korean Won (KRW) per QALY. The probability that CT would be more cost-effective than UC exceeded 50% at a WTP threshold of 30.5 million KRW per QALY.

Conclusions Our study highlights that CT enhances a better quality of life and is more cost-effective for FP treatment, suggesting it is a valuable alternative to usual care. Further large-scale clinical trials and cost-effectiveness studies are warranted to explore its broader application and validate these findings.

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Trial registration The study design was registered with the Clinical Research Information Service (CRIS) of South Korea at https://cris.nih.go.kr/ (KCT0007682) on September 07, 2022.

Keywords Facial palsy, Collaborative treatment, Clinical outcomes, Cost-effectiveness, QALYs

Introduction

Facial palsy (FP) refers to impaired facial movements caused by nerve damage, which can manifest on one or both sides of the face [1]. Affecting approximately 15–40 per 100,000 adults annually [2], FP is a notably common condition, often presenting as sudden-onset unilateral facial paralysis. It is estimated that 29% of FP patients experience long-term complications, including facial asymmetry and synkinesis [3, 4]. Since facial expressions are crucial for interpersonal communication and self-image, FP can significantly diminish quality of life and impose considerable emotional burdens [5]. Despite treatment advances, a significant number of FP patients continue to experience incomplete recovery, potential side effects, and limited efficacy, prompting the exploration of additional therapeutic options [6, 7]. This highlights an increasing need for more treatment options to enhance the overall well-being of FP patients [3].

South Korea, with its unique dichotomized healthcare system that integrates both Korean Medicine (KM) and Western Medicine (WM), provides a distinctive environment for treating FP [4]. KM practices such as acupuncture, moxibustion, and herbal medicine are often used alongside WM treatments to enhance patient outcomes [8, 9]. In 2019, 111,089 patients sought treatment for facial nerve disorders in Korea, making it the most common condition treated in KM hospitals and clinics [10]. FP ranks sixth among frequently treated conditions in outpatient care and tenth in inpatient care for collaborative treatment [4]. Prior studies have explored the efficacy of acupuncture and herbal medicine for FP, with positive patient satisfaction and improvements in recovery and quality of life [3, 5, 6, 10–12]. However, with the increasing use of both medical systems and the constraining coverage of national health insurance, there has been increasing demand for research on the cost-effectiveness and broader economic implications of these collaborative treatments in real-world settings [3, 13]. To address these aspects and smooth institutional implementation of KM-WM collaborative treatment (CT), the South Korean government initiated a national pilot project for CT in 2016 [14]. The first phase identified that collaborative treatment was frequently practiced for musculoskeletal pain, FP, and stroke. In the second phase, collaboration fees were introduced for standard procedures for four major severe diseases. The third phase, which commenced in October 2019, maintained this structure while adding a quality-based differential fee model. By 2022, the fourth phase expanded to 75 institutions to systematize CT and enhance effectiveness research [12, 14].

FP has significant socioeconomic and psychological consequences for patients. Those affected often experience social isolation and decreased confidence, leading to a chain of mental health issues that further increase healthcare utilization and societal costs [5, 10]. A study reported that over 31% of FP patients exhibited significant levels of depression and anxiety [15]. The economic burden of FP extends beyond direct medical costs to include indirect costs such as lost productivity. Therefore, by evaluating treatment outcomes and associated costs, this study aims to address these gaps by providing valuable insights for the effective management of FP. Exploring these aspects will be crucial to determine whether collaborative approaches offer not only clinical benefits but also financial advantages [16]. Along with the fourth phase of the national pilot project for CT, we conducted a prospective observational analysis of the Registry for KM and WM Collaborative Treatment (REKOMENT) to assess and compare the clinical outcomes and cost-effectiveness (utility) of CT with usual care (UC) for FP patients. Our findings may provide significant implications for decision-makers in implementing the CT protocol for FP patients under South Korea's national health insurance (NHI) coverage.

Methods

Study settings

This two-arm comparative, multicenter, prospective, observational study was designed to evaluate and compare the clinical and cost-effectiveness of CT with UC alone for FP patients. Patients were enrolled at 11 nationwide hospitals participating in the fourth phase of the national pilot project for CT. FP was systematically classified using the International Classification of Diseases (ICD-10): G51.0 (Bell's palsy), G51.8 (other disorders of facial nerve), and G51.9 (disorder of facial nerve, unspecified). The study was conducted during the fourth phase of the national CT pilot project from January 26, 2023, to December 19, 2023. The study design was registered with the Clinical Research Information Service (CRIS) of South Korea at https://cris.nih.go.kr/ (KCT0007682) on September 07, 2022 [17]. The study adhered to STROBE, CONSORT, and CHEERS guidelines (Additional Files 1, 2, and 3). Furthermore, the study followed the principles outlined in the Declaration of Helsinki and the Good Research Practices recommended by the International Society for Pharmacoeconomics and Outcomes

Research (ISPOR) [18]. Ethical approval was obtained from the ethical review board of all the following institutions: Mokpo Dongshin University Korean Oriental Hospital (DSMOH-22-04), Daegu Hanny University Hospital (DHUMC-D-22009-AMD-03), Dongguk University Ilsan Oriental Hospital (DHIOH-2022-07-001-004), Kyung Hee University Korean Medicine Hospital (KOMCIRB-2020-03-003-007), Wonkwang University Jeonju Oriental Medicine Hospital (WUJKMH-IRB-2022-007), Chenonan Dosol Korean Oriental Hospital (P01-202011-21-011), Bucheon Jaseng Korean Medicine Hospital (JASENG 2022-08-013-007), Samse Korean Oriental Medical Hospital (P01-202011-21-011), Dong-Eui University Korean Medicine Hospital (DH-2022-10), Woosuk University Jeonju Oriental Medicine Hospital (WSOH-IRB-H2207-03-03), and Kkotdam Hospital of Korean Medicine (P01-202011-21-011). Written informed consent was obtained from all participants.

Study participants

FP patients were enrolled at the study's baseline (the first day of a hospital visit), with follow-up assessments at 4 weeks and 12 weeks post-baseline. The study included patients over 19 years old who visited the participating institutions for the first time and provided written informed consent. Exclusion criteria included difficulties with follow-up, challenges in understanding and responding to research questionnaires, and participation in other clinical studies. As mentioned above, due to the observational nature of the study, investigators from participating institutions and the subjects were not blinded at baseline. However, follow-up assessments and analysis were conducted with blinding at a separate monitoring center, and the process of identifying allocated groups using electronic medical records after the final follow-up was also blinded.

Usual care (UC) and collaborative treatment (CT)

UC refers to the treatment provided exclusively with either KM or WM, whereas CT refers to treatment with both KM and WM. UC with KM included acupuncture, herbal formulations, pharmacopuncture, and physiotherapeutic therapy [19], whereas WM included corticosteroids during the acute phase [20]. Participants who received CT were assigned to the CT group, and those who received UC were assigned to the UC group for the analysis. The detailed intervention protocols for CT and UC in this nationwide pilot project were defined as critical pathways (CP), supported by clinical evidence, methods, and recommendations in the clinical practice guideline (CPG) [19] (Additional File 4).

Baseline information and covariates

Participants' information was collected at each study time point: baseline, 4 weeks, and 12 weeks. Baseline data, including socio-economic and disease-related variables, were collected during the initial visit, whereas clinical and cost-effectiveness indicators were assessed at each time point. Trained and experienced researchers from each institution collected the information using a semi-structured questionnaire, which included clinical and economic case report forms. This questionnaire was developed based on a literature review [3, 4, 10, 21, 22] and in-depth discussions with researchers, clinical professors, and experts from the participating institutions (Additional File 5). Face-to-face interviews were conducted and lasted approximately 15–20 min. We incorporated baseline covariates, including age, gender, monthly income, duration between onset to first hospital visit, and medical utilization and costs before enrollment in the study.

Cost and resource utilization

Cost data were captured using an economic case report form (eCRF) that included direct medical costs, direct non-medical costs, and productivity losses. Direct medical costs from study hospitals were obtained from administrative data, while costs from other hospitals, such as public hospitals, health centers/clinics, and pharmacies, were captured through the eCRF. The study hospital costs were the costs paid (or reimbursed) by participants (and NHI) for their treatment of the study disease during the study period. Direct non-medical costs, such as travel costs and time costs for a hospital visit, were estimated by multiplying hospital visit frequencies by unit travel costs and hourly wages. Productivity loss was calculated based on absenteeism, and presenteeism was not measured to avoid double counting, as the utility measure was already affected by disease status. Since there are no clear guidelines and reasonable friction cost methods for calculating productivity loss in Korea, we used the human capital approach estimation method in this study by simply summing the costs incurred by absenteeism (number of days of absence × cost per day) [9]. As the study's follow-up period did not exceed one year, discount rates for time preferences were not applied to costs and utility outcomes. The unit costs and sources related to direct medical and non-medical costs and productivity losses are provided in Table 1. All cost items in this study were converted to 2024 values using the following formula based on South Korea's annual Consumer Price Index (CPI) [23]:

$$\textit{Converted cost} = \textit{Captured cost} \times (\textit{CPI of 2024} / \textit{CPI of the cost capture year})$$

Table 1 Total costs and QALYs according to treatment group

Variables	UC		CT		Mean difference		*p*-value
	Mean	SD	Mean	SD	Mean	95% CI	
Direct medical costs	2,066,589	2,409,063	2,124,372	1,735,378	57,783	-703,690–819,255	0.881
Study hospital costs	1,423,790	1,809,869	1,785,977	1,626,585	362,187	-282,772–1,007,145	0.268
Other hospital costs	642,798	1,022,049	338,395	734,127	-304,404	-627,009–18,201	0.064
Direct non-medical costs	1,777,464	1,364,516	1,970,253	1,529,612	192,789	-368,291–753,870	0.498
Non-medical costs	46,786	172,887	59,947	222,420	13,162	-65,391–91,714	0.741
Travel costs	266,058	210,793	304,682	252,551	38,624	-52,249–129,497	0.402
Time cost for a hospital visit	1,464,620	1,165,412	1,605,623	1,265,535	141,003	-327,807–609,814	0.553
Productivity loss	2,763,012	2,189,082	3,164,123	2,622,738	401,111	-542,601–1,344,823	0.402
Absence (days)	19.45	15.41	22.28	18.46	2.82	-3.82–9.47	0.402
Total costs (LSP)	3,844,052	3,580,168	4,094,624	3,177,720	250,572	-1,015,835–1,516,979	0.696
Total costs (SP)	6,607,064	5,283,559	7,258,747	5,380,638	651,683	-1,384,345–2,687,711	0.527
QALYs (3 months)	0.001	0.007	0.003	0.006	0.011	0.001–0.022	0.031*

UC, usual care; CT, collaborative treatment; QALYs, quality-adjusted life years; SD, standard deviation; CI, confidence interval; LSP, limited societal perspective; SP, societal perspective; cost in Korean won (KRW); *statistically significant at $p < 0.05$. Absence refers to the mean day's absence at work. The direct medical costs for the study hospital were derived from administrative data. Other hospital costs were measured using data from a cost survey, multiplying the unit cost of 66,821 KRW per day, estimated from the mean value of the study hospital costs. Other hospital costs refer to the costs not identified in the administrative data and are related to other facilities, such as public health centers, clinics, or house calls. Direct non-medical costs include non-medical costs, travel costs, and time costs for hospital visits. The study hospital costs were the costs paid (or reimbursed) by participants (and NHI) for their treatment of the study disease during the study period (12 weeks). The unit cost for traffic expenses was estimated based on the 2005 Korean National Health and Nutritional Survey data analysis [63], with adjustments made using the annual consumer price index (6,839 KRW = 5,105 KRW × (112.70 / 84.129)) [23]. The unit time cost for a hospital visit (14,716 KRW) and the productivity loss per day (142,040 KRW) were derived from the Korean Statistical Information Service database [23]. All cost components were expressed to 2024 Korean Won (KRW) values (one USD = 1363 KRW in 2023) [64]

Clinical effectiveness

The effectiveness of the treatment on FP was evaluated using the House-Brackmann Grading Scale (HBGS), Numeric Rating Scale (NRS), EuroQol-5 Dimensions (EQ-5D-5L), and EuroQol-Visual Analogue Scale (EQ-VAS) at all three time points of the study (at baseline, 4 weeks, and 12 weeks). The HBGS is a validated tool for assessing the severity of facial nerve dysfunction, classifying FP into six grades, from normal function (Grade I) to total paralysis (Grade VI) [24, 25]. Each patient was evaluated and assigned a grade based on facial movement and symmetry. Overall pain intensity and discomfort associated with FP were measured using NRS, where patient rated their pain on a scale from 0 (no pain) to 10 (worst pain imaginable) [26, 27]. The Korean version of EQ-5D-5L was utilized to measure health-related quality of life, focusing on five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with each dimension rated on five levels of severity, from no problems to extreme problems [5, 28]. An increase in EQ-5D scores indicates an improvement in the patient's overall health-related quality of life. The patient's self-rated overall health level was assessed using EQ-VAS on a scale of 0-100 [29, 30]. Higher EQ-VAS scores reflect better perceived health status.

Statistical analyses

Baseline characteristics of the participants were presented using descriptive statistics, including frequencies, percentages, and mean (standard deviation). The normality of the data was assessed using the Shapiro-Wilk test and Q-Q plots. Categorical and continuous variables were analyzed using the Chi-square test and Student's t-test, respectively. The Mann-Whitney U-test and Kruskal-Wallis test were employed when the assumptions of equal variances and normality were violated.

The clinical and cost-effectiveness were assessed using ITT data, with parameter estimates derived based on Rubin's rule [31]. To establish the ITT dataset, the patterns and proportions of missing data were identified, and the mechanism of missingness, along with the imputation model, was determined using Little's test. The total proportion of missing data was 5% (missing participant, 9%), and the mechanism was found to be missing completely at random (MCAR, Chi-square distance = 5.09, p-value = 0.28) (Table 2). Ten imputed datasets were created using multiple imputations, employing a chained equation approach with predictive mean matching based on a K-nearest neighbor algorithm with five neighbors, and the imputed missing values were utility scores of EQ-5D-5L, direct medical costs, direct non-medical costs, and productivity costs for each visit. Upon verifying the covariate associations of the baseline variables, we observed an estimated covariance-dependent missing completely at random mechanism (MCAR-CDM). The MCAR-CDM refers to a situation where the probability of missingness depends on external covariates but remains independent of the observed and unobserved data values [32]. This differs from traditional MCAR, where missingness is entirely random and unrelated to any variables. While MCAR assumes no relationship between missingness and data, MCAR-CDM allows for

Table 2 Summary of censored data for outcome variables

Variables	Never censored	Ever censored	Total
Participant, n (%)			
UC	42 (93)	3 (7)	45 (100)
CT	76 (89)	9 (11)	85 (100)
Total	118 (91)	12 (9)	130 (100)
Periods with data observation, n			
UC	504	12	516
CT	912	60	972
Total	1416	72	1488
Periods with data available, n (%)			
UC	504 (100)	36 (33)	540 (96)
CT	912 (100)	108 (56)	1020 (95)
Total	1416 (100)	144 (50)	1560 (95)
Periods with censored data, %	0	50	5
	Chi-square distance		*p*-value
MCAR test result		5.09	0.28
MCAR (CDM) test result		31.81	0.67

UC, usual care; CT, collaborative treatment; MCAR, missing completely at random; CDM, covariate-dependent missingness; n, frequency

missingness influenced by external covariates without biasing inference, as long as the external covariates are accounted for [32].

To analyze the clinical effectiveness and the between-group differences at each time point, repeated measures analysis of variance (ANOVA) and a generalized linear mixed model (GLMM) adjusted for covariates were employed. All statistical analyses were performed using Stata MP (Version 14.0). The significance level was set at p-value < 0.05.

Cost-effectiveness (utility) analyses

The economic evaluation of the treatment was evaluated using cost-utility analysis, including several economic evaluation metrics: Cost per QALYs (Quality-Adjusted Life Years), Incremental Cost-Effectiveness Ratio (ICER), Net Monetary Benefit (NMB), and Cost-Effectiveness Acceptability Curve (CEAC) [9, 16]. Quality of life was measured using the EQ-5D-5L utilities with the South Korean national tariff [33, 34] and the area under the curve method [35]. ICER was determined by dividing the incremental costs by the incremental QALYs gained [36]. The analysis perspective is a limited societal, similar to a healthcare payer perspective, which is recommended as the reference case analysis for health insurance registration in South Korea [37]. When estimating the cost-effectiveness probability of ICER, we used a threshold of 30,500,000 KRW per QALY, as recommended by Korea's National Evidence-based Healthcare Collaborating Agency (NECA), which reflects the national norms [38, 39] and is also based on the 2023 gross domestic product (GDP) per capita (USD 33,745) [40, 41]. The probability of the collaborative treatment being cost-effective was measured based on changes in the willingness to pay (WTP) for health outcomes [34]. The NMB was calculated using the following equation:

$$NMB = incremental\ effectiveness\ (QALYs) \times WTP - cost\ differences.$$

Sensitivity analysis of cost-effectiveness

Analyses for ICER were performed using both intention-to-treat (ITT) and per-protocol (PP) data from a limited societal perspective (LSP) and societal perspective (SP), displaying the cost-effective probability based on the proposed WTP threshold (KRW/QALY). To address the sampling uncertainty of the ICER's point estimates, 95% confidence intervals (CIs) were calculated using the bootstrapping method (1,000 iterations) and a seemingly unrelated regression model. Additionally, the probabilities of each alternative being cost-effective according to the changes in the national willingness to pay were presented using the CEAC.

Results

A total of 130 FP patients were enrolled in the study and included in the ITT analysis. The CT group consisted of 85 patients, whereas the UC group comprised 45 patients. Out of 130 participants, 118 patients were included in the PP analysis. Twelve patients (three from the UC and nine from the CT group) who failed to complete the follow-ups were excluded. The study process is detailed in Fig. 1.

Baseline information of the participants

Table 3 presents the baseline information of the participants according to the treatment group. The mean age of the participants was 48.49 ± 15.98 years in the UC group and 52.19 ± 14.81 years in the CT group. There were no significant differences between the UC and CT groups according to age, sex, monthly income, duration, HBGS, NRS, EQ-5D-5L, and EQ-VAS assessments (each, $p > 0.05$).

Clinical effectiveness

The mean changes in clinical outcomes across study time points for both treatment groups, analyzed using repeated measures ANOVA with PP data, are shown in Table 4; Fig. 2. FP severity and dysfunction based on HBGS significantly decreased over time in both groups. The UC group's mean HBGS score decreased from 3.40 ± 1.10 at baseline to 1.83 ± 0.85 at 12 weeks, whereas the CT group showed a reduction from 3.28 ± 0.92 to 1.46 ± 0.70. However, there were no significant between-group differences ($p = 0.366$) (Fig. 2A). Similarly, pain levels, assessed using the NRS, showed a significant reduction over time in both groups. In the UC group, the

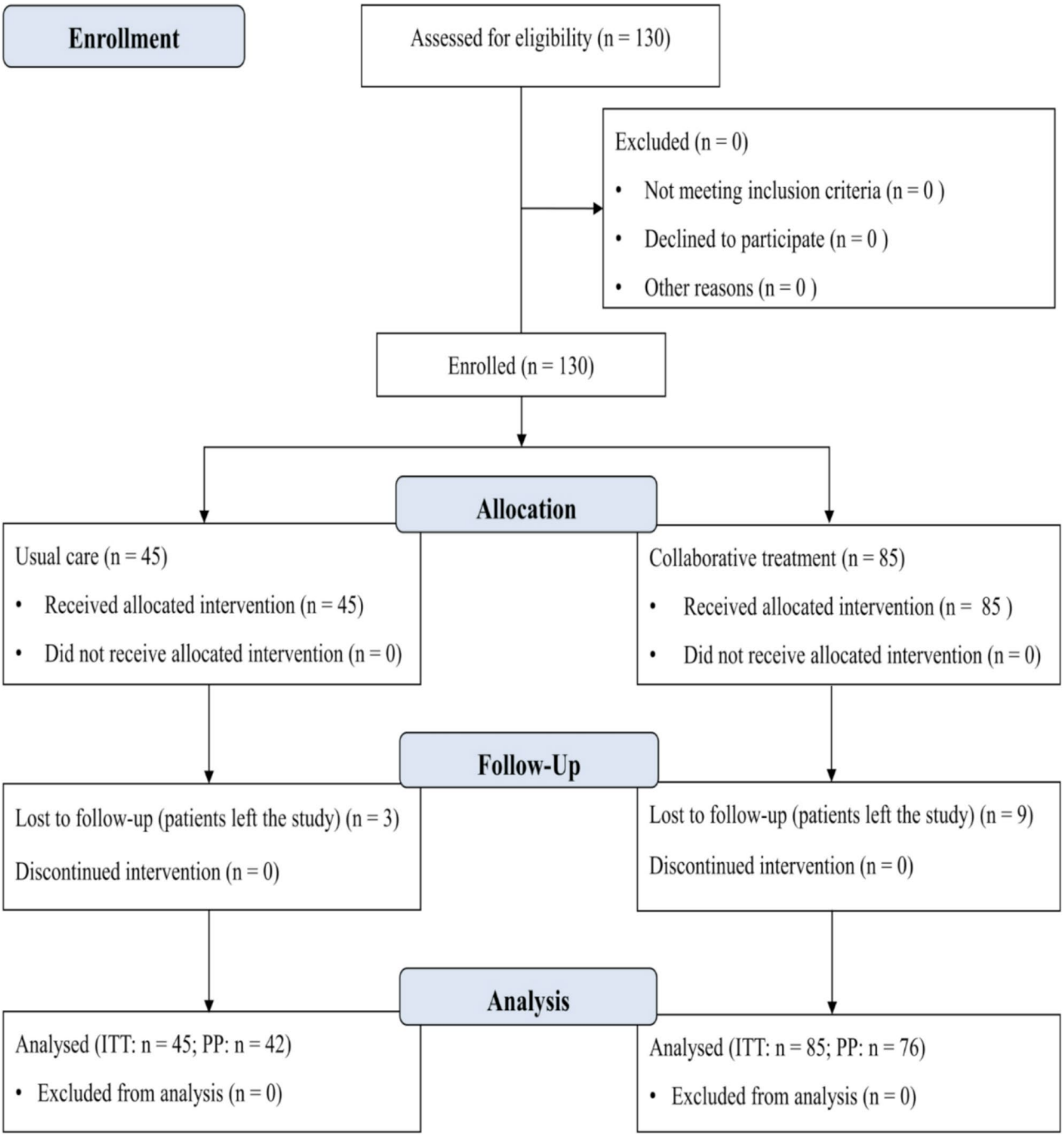

Fig. 1 Study process and flow chart. Collaborative treatment refers to treatment that includes both Korean and Western medicine. Usual care refers to treatment exclusively with either Korean medicine or Western medicine. ITT, intention-to-treat; PP, per-protocol; n, number

mean NRS score decreased from 5.29 ± 2.50 at baseline to 0.33 ± 1.10 at 12 weeks. The CT group exhibited a significant reduction from 4.79 ± 2.18 at baseline to 0.26 ± 0.79 at 12 weeks. However, there were no significant differences in changes over time between the groups (Fig. 2B).

The EQ-5D-5L scores, reflecting quality of life, improved significantly in both groups. In the UC group, the mean EQ-5D-5L score increased from 0.85 ± 0.11 at baseline to 0.91 ± 0.13 at 12 weeks, whereas the CT group exhibited an increase from 0.81 ± 0.12 to 0.94 ± 0.11. Significant within-group ($p < 0.001$) and between-group ($p = 0.044$) effects were observed, indicating that the CT group showed greater improvements in overall quality of life compared to the UC group (Fig. 2C). The EQ-VAS scores showed consistent improvement in both groups over time. The mean EQ-VAS score in the UC group

Table 3 Baseline information of the participants according to treatment group

Variables	UC ($n=45$)	CT ($n=85$)	*p*-value
Age (years)	48.49 ± 15.98	52.19 ± 14.81	0.189
Sex (n, %)			0.805
Male	17 (37.78)	34 (40.00)	
Female	28 (62.22)	51 (60.00)	
Monthly income (KRW in millions) (n, %)			
Unknown	8 (17.78)	7 (8.24)	0.432
< 2	5 (11.11)	12 (14.12)	
2–5	19 (42.22)	33 (38.82)	
5–10	10 (22.22)	28 (32.94)	
> 10	3 (6.67)	5 (5.88)	
Duration	30.78 ± 104.91	17.80 ± 32.43	0.295
HBGS	3.40 ± 1.01	3.28 ± 0.92	0.503
NRS	5.29 ± 2.50	4.78 ± 2.18	0.239
EQ-5D-5L	0.85 ± 0.11	0.82 ± 0.12	0.099
EQ-VAS	64.42 ± 16.58	60.66 ± 21.76	0.313

Values denote mean ± standard deviation. Continuous variables and categorical variables were analyzed using independent t-tests and Chi-square test, respectively, except for income (Fisher's exact test). UC, usual care; CT, collaborative treatment; HBGS, House-Brackmann grading scale; NRS, numeric rating scale; EQ-5D-5L, EuroQol-5 dimensions; EQ-VAS, EuroQol-visual analogue scale; KRW, Korean won; n, frequency; statistically significant at $p < 0.05$

increased from 64.42 ± 16.57 at baseline to 76.28 ± 17.46 at 12 weeks, whereas in the CT group, it increased from 60.66 ± 21.76 to 79.34 ± 18.02. Although the interaction between the group and time did not reach statistical significance, a meaningful difference was observed between the two groups ($p = 0.074$) (Fig. 2D).

We further analyzed the clinical effectiveness of both treatments across study time points using a GLMM analysis with ITT data, as depicted in Table 5. After adjusting for confounding variables, the EQ-5D-5L showed statistically significant differences between the two groups at 12 weeks ($\beta = 0.06$, $p = 0.046$) and marginal significance at 4 weeks ($\beta = 0.05$, $p = 0.072$). The EQ-VAS demonstrated significance at 4 weeks ($\beta = 8.04$, $p = 0.041$) and marginal significance at 12 weeks ($\beta = 6.56$, $p = 0.091$).

Cost-effectiveness (utilities)

Table 1 presents the total costs and QALYs for 3 months according to the treatment group. The mean differences in total costs between the UC and CT groups based on LSP and SP were KRW 250,572 (LSP: UC = KRW 3,844,052 ± 3,580,168; CT = KRW 4,094,624 ± 3,177,720) and KRW 651,683 (SP: UC = KRW 6,607,064 ± 5,283,559; CT = KRW 7,258,747 ± 5,380,638), respectively. The QALYs gained during the study period were significantly higher in patients who received CT than those who received UC ($p = 0.031$).

The results of the cost-effectiveness analysis, including ICER, NMB, and CEAC, are shown in Table 6; Figs. 3

Table 4 Mean variations in clinical outcomes by treatment group across study time points (PP)

Outcomes	Treatment group	Baseline		4 weeks		12 weeks		RM ANOVA		
		Mean	SD	Mean	SD	Mean	SD	Group	Time	Group x Time
HBGS	UC	3.40	1.01	2.17	1.19	1.83	0.85	0.132	< 0.001*	0.366
	CT	3.28	0.92	2.10	1.06	1.46	0.70			
NRS	UC	5.29	2.50	0.52	1.53	0.33	1.10	0.097	< 0.001*	0.251
	CT	4.79	2.18	0.35	1.07	0.26	0.79			
EQ-5D-5L	UC	0.85	0.11	0.87	0.17	0.91	0.13	0.962	< 0.001*	0.044*
	CT	0.81	0.12	0.88	0.13	0.94	0.11			
EQ-VAS	UC	64.42	16.57	71.40	18.71	76.28	17.46	0.629	< 0.001*	0.074
	CT	60.66	21.76	75.85	15.09	79.34	18.02			

UC, usual care; CT, collaborative treatment; HBGS, House-Brackmann grading scale; NRS, numeric rating scale; EQ-5D-5L, EuroQol-5 dimensions; EQ-VAS, EuroQol-visual analogue scale; RM ANOVA, repeated measures analysis of variance; SD, standard deviation; PP, per-protocol; *statistically significant at $p < 0.05$

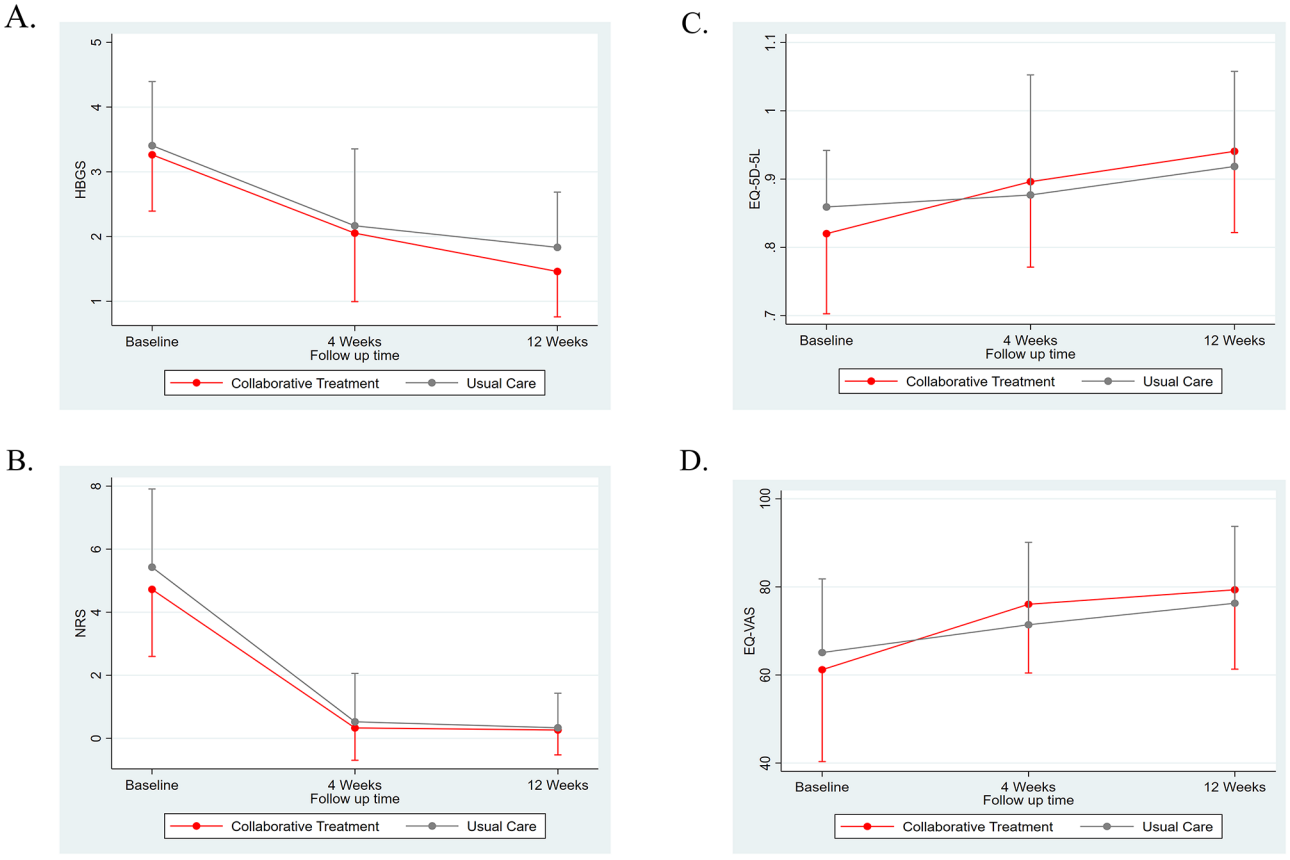

Fig. 2 Mean variations in clinical outcomes during the observation period. (**A**) HBGS, House-Brackmann grading scale; (**B**) NRS, numeric rating scale; (**C**) EQ-5D-5L, EuroQol-5 dimensions; (**D**) EQ-VAS, EuroQol-visual analogue scale

Table 5 GLMM analysis of between-group differences in treatment effectiveness (ITT)

Random effects	HBGS		NRS		EQ-5D-5L		EQ-VAS	
	β	SE	β	SE	β	SE	β	SE
Sex	-0.18	0.13	-0.35	0.18	0.05*	0.02	8.77	2.34
Age	0.01#	0.00	0.01	0.01	0.00	0.00	0.02	0.08
CT	-0.15	0.17	-0.54#	0.29	-0.03	0.02	-3.66	3.26
Duration	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	0.02
Follow up time								
2	-1.24*	0.16	-4.79*	0.32	0.02	0.02	7.01*	3.17
3	-1.57*	0.16	-4.97*	0.32	0.07*	0.02	12.19*	3.18
CT x follow-up time								
CT x 2	0.07	0.21	0.36	0.39	0.05#	0.03	8.04*	3.94
CT x 3	-0.23	0.20	0.44	0.39	0.06*	0.03	6.56#	3.91
constant	3.13*	0.26	5.15*	0.38	0.85*	0.04	57.78*	4.66

β, coefficients; SE, standard error; CT, collaborative treatment; HBGS, House-Brackmann grading scale; NRS, numeric rating scale; EQ-5D-5L, EuroQol-5 dimensions; EQ-VAS, EuroQol-visual analogue scale; GLMM, generalized linear mixed model; ITT, intention-to-treat; * *p*-value < 0.05; # *p*-value < 0.10

and 4. The CT group demonstrated greater quality of life and health benefits than the UC group (0.010 QALYs vs. 0.008 QALYs) at a total mean cost of KRW 279,984 in the bootstrapping model based on ITT analysis. The regression models in sensitivity analysis estimated that the ICER based on mean values was lower than the proposed WTP threshold of 30,500,000 KRW per QALY. At this WTP threshold (KRW per QALY), the probability that CT was more cost-effective than UC exceeded 50% in both PP and ITT analyses. Additionally, the mean NMB at the WTP threshold of 30.5 million KRW per QALY was 18,488 KRW, with a 51% probability.

Table 6 Incremental cost-effectiveness ratio using sensitivity analysis

Analyses	Models	Treatments	Cost	Delta cost	QALYs	Delta QALYs	ICER	Cost-effectiveness probability
PP	SUR	UC	3,844,052		0.007	0.011	21,901,450	0.558
		CT	4,094,624	250,572	0.018			
	Bootstrapping	UC	3,857,560		0.006	0.011	20,403,721	0.565
		CT	4,090,026	232,466	0.018			
ITT	SUR	UC	3,854,400		0.008	0.008	28,988,185	0.509
		CT	4,144,063	289,663	0.016			
	Bootstrapping	UC	3,854,400		0.008	0.010	28,141,591	0.510
		CT	4,134,383	279,984	0.018			

UC, usual care; CT, collaborative treatment; PP, per-protocol; ITT, intention-to-treat; SUR, seemingly unrelated regression model; QALYs, quality-adjusted life years; ICER, Incremental cost-effectiveness ratio; cost in Korean won (KRW)

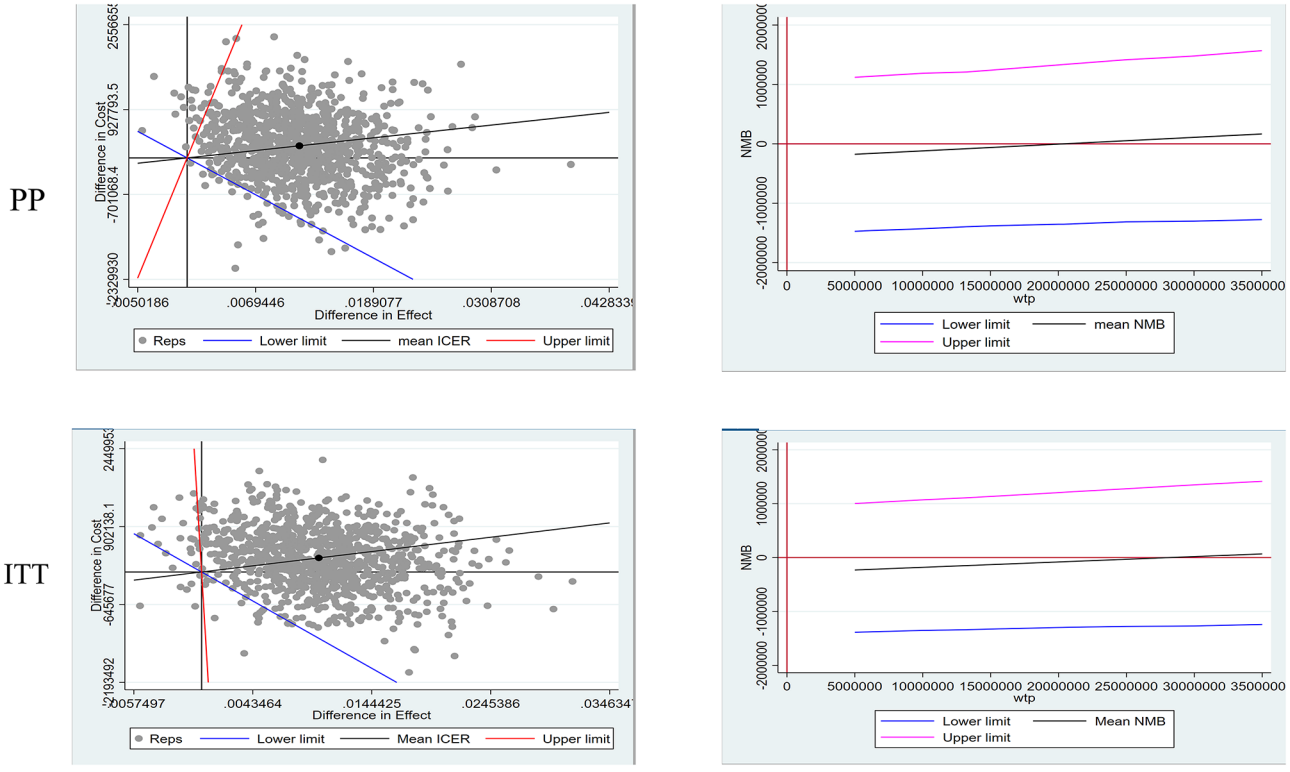

Fig. 3 Cost-effectiveness analysis of the treatment according to intention-to-treat (ITT) and per-protocol (PP) analysis. Values were calculated using 95% CI bootstrapping (1,000 iterations) for the incremental cost-effectiveness ratio (ICER) and the 95% CI for net monetary benefit (NMB) according to variations in the national threshold. WTP, willingness to pay (KRW/QALY); cost in Korean won (KRW)

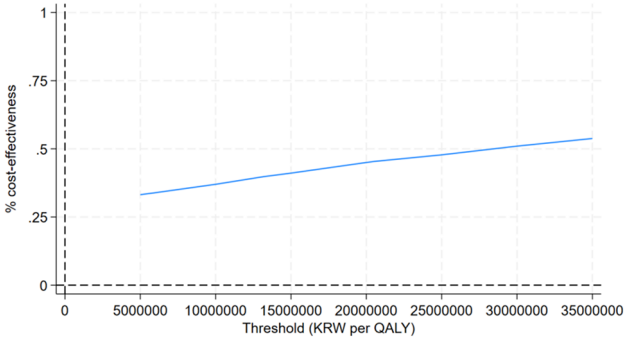

Fig. 4 Cost-effectiveness acceptability curve (CEAC) of collaborative treatment. QALY, quality-adjusted life years; KRW, Korean won

Discussion

To the best of our knowledge, this is the first study to explore and compare the clinical and cost-effectiveness of CT with UC alone for FP patients in the fourth phase of the national pilot project for CT. Our findings demonstrated that CT significantly improves the health-related quality of life compared to UC alone. Additionally, CT showed greater cost-utility gains based on QALYs, indicating that CT not only enhances clinical outcomes but also offers a sustainable economic alternative for FP treatment.

The importance of clinical and cost-effectiveness evidence in healthcare cannot be overstated. Policymakers

require robust data to allocate resources efficiently and design health interventions that yield the best outcomes for patients [4, 42]. The findings from this study reinforce the need for evidence-based healthcare practices, demonstrating that CT offers substantial benefits over UC alone. This aligns with similar findings in other studies that emphasize the value of integrating various treatment modalities, thereby optimizing patient care and enhancing quality of life [13, 43]. Moreover, cost-effectiveness evidence is critical for supporting the inclusion of novel treatments in national healthcare systems, thereby making them accessible to a wider population [4, 6, 44]. An increasing body of literature assesses the efficacy and economic evaluation of complementary and alternative medicine (CAM) globally [6, 9, 21, 22, 45]. Studies conducted in South Korea and Europe have shown that acupuncture significantly alleviates pain in patients with low back pain and neurological disorders, demonstrating its potential as an alternative treatment [9, 22, 46]. Additionally, CAM therapies, such as herbal medicine and acupuncture, often result in cost savings and improved clinical outcomes for chronic conditions [13, 34]. These highlight the global trend of integrating CAM into conventional healthcare systems and influencing healthcare decisions to support such collaboration [47, 48].

Several studies have reported the clinical effectiveness of CT for FP [6, 49, 50]. A randomized controlled trial showed CT combined with steroids was more effective in treating FP [51]. Studies from Turkey and China reported a significant reduction in HBGS scores in FP patients treated with acupuncture [52], as well as improvements in disability and quality of life [53]. A study in South Korea observed a significant onset of FP after 2 (OR, 1.47) and 3 months (OR, 2.05) of treatment based on the HBGS index [6]. The increasing use of CT for FP in South Korea indicates a rising patient preference for CT. FP patients treated with CT reported higher satisfaction with the treatment and recognized it as a primary treatment for FP [54]. A study by Ga Young et al. showed that FP treatment over 6 months significantly improved both HBGS (5 to 3) and NRS (10 to 2.5) scores [55]. Furthermore, over 85% of the patients treated with CT fully recovered within 2 months [56]. These findings align with our study, demonstrating that CT for FP has a substantial and greater impact on clinical outcomes than UC. Although the economic evaluation of CT for FP is critical for assessing its overall effectiveness, this area remains underexplored in South Korea. This gap is one of the major strengths of our study. However, some studies in South Korea and abroad have demonstrated that CT is significantly cost-effective in treating low back pain and osteoarthritis compared to UC [9, 34, 57]. A study in the UK assessed the economic evaluation of steroids for FP and showed a 77% probability of cost-effectiveness at £30,000 [58]. In our study, CT demonstrated greater cost-effectiveness than UC alone for FP treatment, with a 55% probability of willingness to pay at the WTP threshold level of 30,500,000 KRW per QALY. The cost-effectiveness of CT for FP may be influenced by multiple factors, including variations in treatment protocols, differences in healthcare systems, and patient adherence. Additionally, long-term cost benefits should be explored, as effective FP management through CT may reduce the need for repeated interventions and additional healthcare expenses. Therefore, further studies should incorporate large-scale real-world data on costs and utilities to enhance the generalizability and robustness of economic evaluations.

The CT pilot project is a groundbreaking initiative aimed at fostering effective collaboration of KM and WM for the treatment of diverse health conditions, including FP, in South Korea. This collaboration is essential in meeting the growing demand for holistic and comprehensive healthcare solutions. By leveraging the strengths of both KM and WM, the pilot project could serve as a model for other countries, demonstrating how CAM and modern medical practices can work synergistically to improve patient care [12, 14, 59]. Such collaboration reflects a broader recognition of diverse treatment modalities, aligning with the World Health Organization's recommendations on incorporating collaborative medicine into national health systems [60, 61]. Our study has significant scientific implications, particularly for the fields of collaborative medicine and health economics. Given the scarcity of studies investigating the clinical and cost-effectiveness of CT for FP, this research contributes to the growing discourse and clinical guidelines on the collaboration of KM and WM in South Korea [3]. It paves the way for further studies exploring similar collaborative approaches for other medical conditions, enhancing our understanding of the potential benefits and cost savings associated with collaborative care [62]. Therefore, the positive outcomes observed in this study could benefit future research investigating the mechanisms by which CT leads to improved patient outcomes across various healthcare conditions, including FP.

Although our study provides valuable insights, several limitations must be acknowledged. First, this was an observational study rather than a randomized controlled trial, which may limit the definitive conclusions about cost-effectiveness. However, it is important to note that observational studies still play a critical role in real-world evidence generation, especially in contexts where experimental studies are challenging to conduct due to logistical, ethical, or economic reasons. This study represents a significant milestone as the first-ever study in Korea to assess the comparative cost-effectiveness of CT for FP and provides an essential baseline foundation and

valuable insights into collaborative treatment approaches for FP. Second, despite adjusting for covariates such as age, gender, income, and duration between onset to first visit, and addressing missing data mechanisms, certain biases—such as sample selection and measurement error—may not have been fully mitigated, potentially limiting the generalizability of the findings. Third, although this was a multicenter prospective study, the sample size was not large enough to comprehensively investigate clinical outcomes and cost-effectiveness with adequate statistical power. Fourth, although the study protocol was not published, the study design was properly registered with CRIS. Lastly, it is widely acknowledged that cost utilization surveys may introduce recall bias. Despite these limitations, our findings highlight the potential effectiveness of CT for FP treatment and areas for future research. These findings help bridge the existing evidence gap in CT effectiveness for FP and underscore the importance of collaborative healthcare models. We believe that our study stimulates further investigation, particularly through long-term, large-scale randomized controlled trials and a more diverse demographic representation, which can provide more robust and generalizable conclusions, particularly in terms of cost-effectiveness [9].

Conclusion

This study underscores the greater clinical and cost-effectiveness of KWCT for FP, indicating it as a valuable alternative to usual care. Particularly, the probability of CT being cost-effective exceeded 50% at a WTP threshold of 30,500,000 KRW per QALY over three months. Therefore, further large-scale clinical trials and cost-effectiveness models are warranted to explore its border application, and long-term effectiveness, and validate these findings. Additionally, the CT pilot project would effectively align patient-centered care principles with optimized health outcomes and economic advantages from a limited societal perspective. Policymakers would benefit from considering this evidence in future healthcare planning, and decision-making, and in promoting CT for various health conditions.

Abbreviations

CT	Collaborative treatment
UC	Usual care
FP	Facial palsy
HBGS	House-Brackmann Grading Scale
NRS	Numeric Rating Scale
EQ-5D-5L	EuroQol-5 Dimensions
EQ-VAS	EuroQol-Visual Analogue Scale
QALYs	Quality-Adjusted Life Years
ICER	Incremental Cost-Effectiveness Ratio
CEAC	Cost-Effectiveness Acceptability Curve
NMB	Net Monetary Benefit
WTP	Willingness to pay
ITT	Intention-to-treat
PP	Per-protocol
LSP	Limited societal perspective
SP	Societal perspective
MCAR	Missing completely at random mechanism
CRIS	Clinical Research Information Service
NHI	National Health Insurance
KM	Korean medicine
WM	Western medicine
REKOMENT	Registry for KM and WM Collaborative Treatment

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Supplementary Material 5

Author contributions

Conceptualization, Methodology: NamKwen Kim. Acquisition, Data curation, Editing, Investigation: NamKwen Kim, Linae Kim. Writing- original draft: Shiva Raj Acharya, NamKwen Kim. Writing-critical review: NamKwen Kim, Linae Kim, Shiva Raj Acharya,. Statistical analysis: NamKwen Kim, Shiva Raj Acharya. Supervision: NamKwen Kim.

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Data availability

The datasets generated during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval and consent to participate

The study adhered to the principles outlined in the Declaration of Helsinki and the Good Research Practices recommended by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) [18]. The study design was registered with the Clinical Research Information Service (CRIS) of South Korea at https://cris.nih.go.kr/ (KCT0007682) on September 07, 2022 [17]. The study adhered to STROBE, CONSORT, and CHEERS guidelines (Additional Files 1, 2, and 3). Ethical approval was obtained from the ethical review board of all the following institutions: Mokpo Dongshin University Korean Oriental Hospital (DSMOH-22-04), Daegu Hanny University Hospital (DHUMC-D-22009-AMD-03), Dongguk University Ilsan Oriental Hospital (DHIOH-2022-07-001-004), Kyung Hee University Korean Medicine Hospital (KOMCIRB-2020-03-003-007), Wonkwang University Jeonju Oriental Medicine Hospital (WUJKMH-IRB-2022-007), Chenonan Dosol Korean Oriental Hospital (P01-202011-21-011), Bucheon Jaseng Korean Medicine Hospital (JASENG 2022-08-013-007), Samse Korean Oriental Medical Hospital (P01-202011-21-011), Dong-Eui University Korean Medicine Hospital (DH-2022-10), Woosuk University Jeonju Oriental Medicine Hospital (WSOH-IRB-H2207-03-03), and Kkotdam Hospital of Korean Medicine (P01-202011-21-011). Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Ragaban A, Alsharif L, Alshaikh NA, Jafar RJ, Hemeq Z, Khan MA, et al. Prevalence, etiology, risk factors, and complications of facial nerve palsy at King Abdulaziz medical City: A multicenter study. Cureus. 2024;16(2):e53403. https://doi.org/10.7759/cureus.53403.
2. Jeong J, Yoon SR, Lim H, Oh J, Choi HS. Risk factors for Bell's palsy based on the Korean National health insurance service National sample cohort data. Sci Rep. 2021;11(1):23387. https://doi.org/10.1038/s41598-021-02816-9.
3. Lee JA, Kim JU, Choi J, Jun JH, Choi TY, Yook TH, et al. Clinical practice guidelines of Korean medicine for facial palsy: an evidence-based approach. Eur J Integr Med. 2016;8(3):176–81. https://doi.org/10.1016/j.eujim.2015.10.009.
4. Kim D, Jung B, Cho M-U, Song S-B, Chung SH, Park T-Y, et al. Analysis of medical services provided to patients with peripheral facial palsy in Korea: a descriptive, cross-sectional study of the health insurance review and assessment service National patient sample database. BMC Health Serv Res. 2021;21(1):1178. https://doi.org/10.1186/s12913-021-07078-9.
5. Kim S, Lee HY, Kim NK, Yook TH, Seo ES, Kim JU. The association between paralytic side and health-related quality of life in facial palsy: a cross-sectional study of the Korea National health and nutrition examination survey (2008–2012). Health Qual Life Outcomes. 2018;16(1):213. https://doi.org/10.1186/s12955-018-1038-0.
6. Suk KH, Lee JH, Ryu SH, Lee SY, Kim HG, Ryoo DW, et al. Effectiveness of East-West collaborative hospital treatment on the prognosis of Bell's palsy: A retrospective study. J Acupunct Res. 2015;32(4):167–75. https://doi.org/10.13045/acupunct.2015071.
7. Lee SY, Seong J, Kim YH. Clinical implication of facial nerve decompression in complete Bell's palsy: A systematic review and Meta-Analysis. Clin Exp Otorhinolaryngol. 2019;12(4):348–59. https://doi.org/10.21053/ceo.2019.00535.
8. Kim JH, Goo B, Nam SS. A spadework for integrative medicine based critical pathways for facial palsy: Web-based survey from traditional Korean medicine Doctors. Med (Baltim). 2022;101(40):e30161. https://doi.org/10.1097/md.0000000000030161.
9. Kim N, Shin K-M, Seo E-S, Park M, Lee H-Y. Electroacupuncture with usual care for patients with Non-Acute pain after back surgery: Cost-Effectiveness analysis alongside a randomized controlled trial. Sustainability. 2020;12(12):5033.
10. Lim H, Lee Y, Lee S, Kim YS. Effectiveness and safety of Korean medicine treatment based on the clinical practice guidelines in patients with acute peripheral facial palsy: A protocol for a multicenter, prospective, observational study. Med (Baltim). 2022;101(27):e29864. https://doi.org/10.1097/md.0000000000029864.
11. Park GNJJ, Kim ES, Kim JH, Kim YI. Prognostic factors of idiopathic facial palsy: A retrospective study. J Acupunct Res. 2017;34(2):23–38.
12. Park S, Lee Y, Kim L, Acharya SR, Kim N. Assessing patient satisfaction and the need for collaborative treatment with Korean and Western medicine. Healthcare. 2024;12(18):1901.
13. Gong NGSE, Seon JH, Kim N. Systematic review for the development of the clinical study with economical assessment protocol on facial palsy. J Korean Med. 2017;38(1):46–55.
14. Health Insurance Review and Assessment Service. Guidelines for the pilot project in the fourth stage of Western medicine and Korean medicine collaborative care program. https://www.hira.or.kr/bbsDummy.do?pgmid=HIRAA020002000100&brdScnBltNo=4&brdBltNo=9589. (2022). Accessed March 15 2023.
15. Fu L, Bundy C, Sadiq SA. Psychological distress in people with disfigurement from facial palsy. Eye (Lond). 2011;25(10):1322–6. https://doi.org/10.1038/eye.2011.158.
16. Polsky D, Baiocchi M. Observational studies in economic evaluation. In: Culyer AJ, editor. Encyclopedia of health economics. San Diego: Elsevier; 2014. pp. 399–408.
17. Clinical Research Information Service (CRIS). South Korea. https://cris.nih.go.kr/cris/search/detailSearch.do?seq=28473&search_page=L (2022). Accessed September 25 2024.
18. Berger ML, Dreyer N, Anderson F, Towse A, Sedrakyan A, Normand SL. Prospective observational studies to assess comparative effectiveness: the ISPOR good research practices task force report. Value Health. 2012;15(2):217–30. https://doi.org/10.1016/j.jval.2011.12.010.
19. Kim N. Korean Medicine Clinical Practice Guideline for Facial Palsy. Korean Acupuncture and Moxibustion Medicine Society, Republic of Korea. 2021.
20. Kim SJ, Lee HY. Acute peripheral facial palsy: recent guidelines and a systematic review of the literature. J Korean Med Sci. 2020;35(30):e245. https://doi.org/10.3346/jkms.2020.35.e245.
21. Jaewon K, Yongsuk K. A clinical study of collaboration between Western and Korean medicine for the treatment of peripheral facial palsy in a Korean medicine hospital. J Acupunct Res. 2020;37(3):161–6. https://doi.org/10.13045/jar.2020.00115.
22. Lee H-Y, Cho MK, Kim N, Lee SY, Gong N-G, Hyun EH. Comparative effectiveness of collaborative treatment with Korean and Western medicine for low back pain: A prospective cohort study. Evidence-Based Complement Altern Med. 2021;2021(1):5535857. https://doi.org/10.1155/2021/5535857.
23. Korean Statical Information Service database (KOSIS). Statistics Korea. https://kosis.kr/eng/ (2024). Accessed July 15 2024.
24. Reitzen SD, Babb JS, Lalwani AK. Significance and reliability of the House-Brackmann grading system for regional facial nerve function. Otolaryngol Head Neck Surg. 2009;140(2):154–8. https://doi.org/10.1016/j.otohns.2008.11.021.
25. Evans RA, Harries ML, Baguley DM, Moffat DA. Reliability of the house and Brackmann grading system for facial palsy. J Laryngol Otol. 1989;103(11):1045–6. https://doi.org/10.1017/s002221510011093x.
26. Lee J, Kwon S, Kim M, Song J, Kim P, Seo B. A study of facial palsy sequelae and evaluating scale. J Korean Acupunct Moxibustion Soc. 2011;28:75–87.
27. Silverberg JI. Validity and reliability of a novel numeric rating scale to measure skin-pain in adults with atopic dermatitis. Arch Dermatol Res. 2021;313(10):855–61. https://doi.org/10.1007/s00403-021-02185-3.
28. Kim SH, Ahn J, Ock M, Shin S, Park J, Luo N, et al. The EQ-5D-5L valuation study in Korea. Qual Life Res. 2016;25(7):1845–52. https://doi.org/10.1007/s11136-015-1205-2.
29. Sang-Seokg S, Chan-Bum MD, Yoon-Kyoung CMD. Health-Related quality of life using EQ-5D in Koreans. J Rheum Dis. 2004;11(3):254–62.
30. Cheng LJ, Tan RL, Luo N. Measurement properties of the EQ VAS around the Globe: A systematic review and Meta-Regression analysis. Value Health. 2021;24(8):1223–33. https://doi.org/10.1016/j.jval.2021.02.003.
31. Rubin DB. Inference and missing data. Biometrika. 1976;63(3):581–92. https://doi.org/10.1093/biomet/63.3.581.
32. Hossain A, Diaz-Ordaz K, Bartlett JW. Missing continuous outcomes under covariate dependent missingness in cluster randomised trials. Stat Methods Med Res. 2017;26(3):1543–62. https://doi.org/10.1177/0962280216648357.
33. Lee YK, Nam HS, Chuang LH, Kim KY, Yang HK, Kwon IS, et al. South Korean time trade-off values for EQ-5D health States: modeling with observed values for 101 health States. Value Health. 2009;12(8):1187–93. https://doi.org/10.1111/j.1524-4733.2009.00579.x.
34. Hyun E, Shin B-C, Kim N, Lim B. Economic evaluation of acupuncture as an adjunctive treatment with usual care for mild-to-moderate knee osteoarthritis: A Markov model-based analysis. Integr Med Res. 2023;12(3):100982. https://doi.org/10.1016/j.imr.2023.100982.
35. Richardson G, Manca A. Calculation of quality adjusted life years in the published literature: a review of methodology and transparency. Health Econ. 2004;13(12):1203–10. https://doi.org/10.1002/hec.901.
36. Ramsey SD, Willke RJ, Glick H, Reed SD, Augustovski F, Jonsson B, et al. Cost-Effectiveness analysis alongside clinical trials II—An ISPOR good research practices task force report. Value Health. 2015;18(2):161–72. https://doi.org/10.1016/j.jval.2015.02.001.
37. Bae EY, Hong J, Bae S, Hahn S, An H, Hwang EJ, et al. Korean guidelines for Pharmacoeconomic evaluations: updates in the third version. Appl Health Econ Health Policy. 2022;20(4):467–77. https://doi.org/10.1007/s40258-022-00721-4.
38. Choi HY, Kim K-A, Park BY, Choi BY, Ki M. Economic evaluation of mass screening as a strategy for hepatitis C virus elimination in South Korea. J Infect Public Health. 2025;18(3):102662. https://doi.org/10.1016/j.jiph.2025.102662.
39. National Evidence-based Healthcare Collaborating Agency (NECA). Cost-Effectiveness Evaluation Manual. https://www.neca.re.kr/lay1/bbs/S1T11C102

/F/39/view.do?article_seq=8783&cpage=1&rows=10&condition=&keyword=&show=&cat= (2021). Accessed June 15 2024.
40. Korean Statistical Information Service (KOSIS). National Accounts. GDP per capita.: https://kosis.kr/eng/statisticsList/statisticsListIndex.do?parentId=S1.1&menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01#content-group (2023). Accessed July 15 2024.
41. Kim K, Hong MJ, Kim B, Lee H-Y, Kim TH. Cost-effectiveness of strengthening blood pressure classification in South Korea: comparing the 2017 ACC/AHA and KSH guidelines. Clin Hypertens. 2024;30(1):34. https://doi.org/10.1186/s40885-024-00289-2.
42. Hong MJUT, Kim S, Kim NK. Medical costs for patients with facial paralysis: based on health big data. J Korean Med. 2015;36(3):98–110.
43. Lee B, Kwon CY, Lee HW, Nielsen A, Wieland LS, Kim TH, et al. Different outcomes according to needling point location used in Sham acupuncture for Cancer-Related pain: A systematic review and network Meta-Analysis. Cancers (Basel). 2023;15(24). https://doi.org/10.3390/cancers15245875.
44. Fehily C, Ling R, Searles A, Bartlem K, Wiggers J, Hodder R, et al. An economic evaluation of a specialist preventive care clinician in a community mental health service: a randomised controlled trial. BMC Health Serv Res. 2020;20(1):405. https://doi.org/10.1186/s12913-020-05204-7.
45. Lee HY, Kang HW, Kim N, Hyun EH, Seo JH, Lyu YS, et al. Effectiveness of collaborative treatment using Korean and Western medicine for mild cognitive impairment or dementia: A protocol for a prospective observational exploratory study. Med (Baltim). 2018;97(35):e12098. https://doi.org/10.1097/md.0000000000012098.
46. Canter PH, Coon JT, Ernst E. Cost-effectiveness of complementary therapies in the united kingdom-a systematic review. Evid Based Complement Alternat Med. 2006;3(4):425–32. https://doi.org/10.1093/ecam/nel044.
47. Joos S, Musselmann B, Miksch A, Rosemann T, Szecsenyi J. The role of complementary and alternative medicine (CAM) in Germany – A focus group study of gps. BMC Health Serv Res. 2008;8(1):127. https://doi.org/10.1186/1472-6963-8-127.
48. Maghsoudi T, Cascón-Pereira R, Beatriz Hernández Lara A. The role of collaborative healthcare in improving social sustainability: A conceptual framework. Sustainability. 2020;12(8):3195.
49. Machetanz K, Oberle L, Wang SS, Weinbrenner E, Gorbachuk M, Lauer H, et al. Outpatient care for facial palsy-a survey on patient satisfaction in uni- and interdisciplinary approaches. Front Neurol. 2024;15:1354583. https://doi.org/10.3389/fneur.2024.1354583.
50. Lee SM, Lee S, Park JH, Park JJ, Lee S. A close look at an integrative treatment package for Bell's palsy in Korea. Complement Ther Clin Pract. 2017;26:76–83. https://doi.org/10.1016/j.ctcp.2016.12.003.
51. Lee HY, Byun JY, Park MS, Yeo SG. Steroid-antiviral treatment improves the recovery rate in patients with severe Bell's palsy. Am J Med. 2013;126(4):336–41. https://doi.org/10.1016/j.amjmed.2012.08.020.
52. Öksüz CE, Kalaycıoğlu A, Uzun Ö, Kalkışım ŞN, Zihni NB, Yıldırım A, et al. The efficacy of acupuncture in the treatment of Bell's palsy sequelae. J Acupunct Meridian Stud. 2019;12(4):122–30. https://doi.org/10.1016/j.jams.2019.03.001.
53. Xu S-b, Huang B, Zhang C-y, Du P, Yuan Q, Bi G-j, et al. Effectiveness of strengthened stimulation during acupuncture for the treatment of bell palsy: a randomized controlled trial. Can Med Assoc J. 2013;185(6):473. https://doi.org/10.1503/cmaj.121108.
54. Ko M-J, Chae S-Y, Lee S, Lee D, Song J, Park J, et al. A pilot survey examining satisfaction for integrated medicine based on critical pathways for acute facial palsy. J Acupunct Res. 2023;40(3):245–51. https://doi.org/10.13045/jar.2023.00178.
55. Ga-Young C, Yu-Kyeong P, Sang Ha W, Jung Hee L, Yun Kyu L, Hyun-Jong L, et al. Facial Chuna manual therapy and acupuncture treatment for the sequelae of peripheral facial nerve palsy: two clinical cases. J Acupunct Res. 2022;39(1):70–5. https://doi.org/10.13045/jar.2021.00269.
56. Hyeon Kyu C, Min Ju K, Young Rok L, Hyun Ji C, Hyun Jin J, So Jeong K, et al. Characteristics and treatment methods of Bell's palsy in patients visiting Korean medicine hospitals from August 2018 to July 2021. J Acupunct Res. 2022;39(2):122–33. https://doi.org/10.13045/jar.2022.00073.
57. Witt CM, Jena S, Selim D, Brinkhaus B, Reinhold T, Wruck K, et al. Pragmatic randomized trial evaluating the clinical and economic effectiveness of acupuncture for chronic low back pain. Am J Epidemiol. 2006;164(5):487–96. https://doi.org/10.1093/aje/kwj224.
58. Hernández R, Sullivan F, Donnan P, Swan I, Vale L, Group ftBT. Economic evaluation of early administration of prednisolone and/or aciclovir for the treatment of Bell's palsy. Fam Pract. 2009;26(2):137–44. https://doi.org/10.1093/fampra/cmn107.
59. Lee HY, Cho MK, Kim N, Lee SY, Gong NG, Hyun EH. Comparative effectiveness of collaborative treatment with Korean and Western medicine for low back pain: A prospective cohort study. Evid Based Complement Alternat Med. 2021;2021:5535857. https://doi.org/10.1155/2021/5535857.
60. World Health O. WHO traditional medicine strategy: 2014–2023. Geneva: World Health Organization; 2013.
61. Lee J, Ji ES. Effect of an integral care system: a combination of Oriental and Western care for older adults with degenerative arthritis. J Korean Acad Nurs. 2011;41(1):18–25. https://doi.org/10.4040/jkan.2011.41.1.18.
62. Raja M, Cramer H, Lee MS, Wieland LS, Ng JY. Addressing the challenges of traditional, complementary, and integrative medicine research: an international perspective and proposed strategies moving forward. Perspect Integr Med. 2024;3(2):86–97. https://doi.org/10.56986/pim.2024.06.004.
63. Korean National Health and Nutritional Survey Data (KNHANES). https://knhanes.kdca.go.kr/knhanes/eng/intr/dataIntr.do (2005). Accessed July 20 2024.
64. National Health Insurance Service. Health insurance premium rate. https://www.nhis.or.kr/nhis/together/wbhaea01600m01.do (2023). Accessed June 15 2024.

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