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Original Article

## A Retrospective Statistical Analysis of Miniscalpel Needle Therapy for Herniated Intervertebral Disc or Spinal Stenosis

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### ABSTRACT

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#### Keywords:

acupuncture, herniated disc, spinal stenosis

**Background:** This study examined the characteristics and prognosis of patients admitted to the Dunsan Korean medicine hospital for treatment of herniated intervertebral disc (HIVD) or spinal stenosis with Miniscalpel needle therapy (MSN).

**Methods:** Patients were admitted to the Dunsan Korean medicine hospital from January 01, 2016 to September 30, 2017 for the treatment of HIVD or spinal stenosis with MSN. Crossover analysis, Independent sample *t* test, one-way ANOVA, multiple linear regression analysis, and binary logistic regression analysis were performed.

**Results:** Crossover analysis showed statistically significant differences in treatment methods according to gender, current pain according to the disease duration, satisfaction of MSN according to disease duration, treatment methods, and intention of re-treatment with MSN according to treatment methods. Independent *t* test and one-way ANOVA showed that there was a difference in current Numeric Rating Scale (NRS) according to disease duration, and difference between discharge and current NRS, and number of MSN according to disease. Multiple linear regression analysis showed that age, disease duration, and number of MSN affect discharge NRS, disease duration, and number of MSN affect current NRS, and Western medical treatment after MSN, discharge NRS, and current NRS affect satisfaction of MSN. Binary logistic regression analysis showed that discharge NRS affects current pain, and gender, discharge NRS, and treatment methods affect intention of re-treatment with MSN.

**Conclusion:** Characteristics, prognosis, satisfaction and variables affecting prognosis of MSN were statistically significant, indicating that more systematic studies are required to further examine the effects of MSN on HIVD or spinal stenosis.

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### Introduction

The “2016 Health Insurance Statistical Yearbook” showed that among the patients admitted to Korean medicine hospitals, 6,207 (15th) and 25,256 (5th) patients were treated for cervical herniated intervertebral disc (M50, cervical disc disorder), and lumbar herniated intervertebral disc (M51, other disc disorders), respectively, and 7,159 patients treated for spinal stenosis (M480), with the incidence of these disorders increasing steadily [1-5]. The herniated intervertebral disc (HIVD) is a disease in which the nucleus pulposus ruptures to the outside of the ruptured annulus fibrosus. It may cause post neck or back pain, and radiating pain or numbness in the upper or lower extremities [6]. Spinal stenosis is a narrowing of the spinal or neural canal due to degenerative

changes in the spinal structure. It causes various neurological symptoms such as pain, radiating pain, and claudication [6].

Miniscalpel needle therapy (MSN) is a Korean medical treatment method that peels the adhesion of soft tissue using a flat knife on the tip of the acupuncture needle. Recently, it has been used for chronic pain caused by soft tissue injury [7], mainly for musculoskeletal diseases [8], and has excellent effects on spinal diseases such as HIVD and spinal stenosis [9-12]. However, there have been very few studies analyzing the factors affecting the prognosis of HIVD or spinal stenosis patients treated with MSN. In this study, a retrospective analysis was performed to evaluate the prognostic factors in patients who were admitted to the Dunsan Korean medicine hospital of Daejeon University from January 01, 2016 to September 30, 2017 for the treatment of herniated

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intervertebral disc or spinal stenosis with MSN, and the patients' satisfaction of MSN treatment evaluated.

**Materials and Methods**

**Participants**

Patients were selected ( $n = 95$ ) who had been admitted to and treated for HIVD or spinal stenosis (diagnosed with Computed Tomography or Magnetic Resonance Imaging) with MSN from January 1, 2016, to September 30, 2017, at the Department of Acupuncture & Moxibustion at the Dunsan Korean medicine hospital of Daejeon University. In cases where patients were readmitted, the total number of treatments was combined. Patients were excluded if their current status could not be confirmed due to death or change in their contact information, or if they refused to answer the telephone survey (Fig. 1).

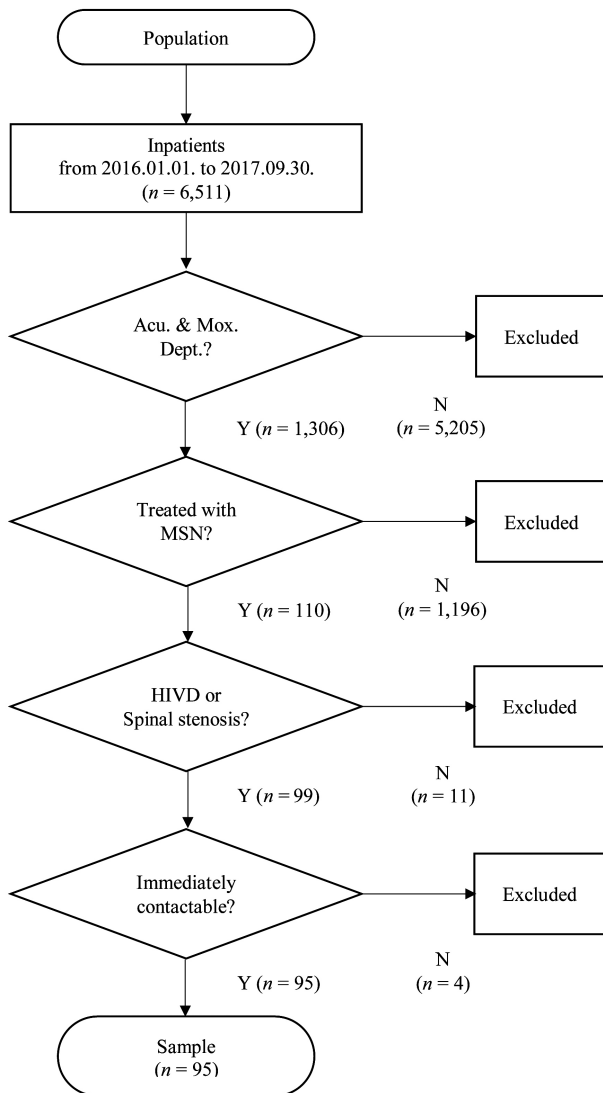


Fig. 1. Flowchart of process of sample extracting.

Acu. & Mox. Dept., Department of Acupuncture and Moxibustion; HIVD, herniated intervertebral disc; MSN, Miniscalpel Needle Therapy.

**Method**

The Institutional Review Board at Dunsan Korean medicine hospital of Daejeon University reviewed the study proposal prior to the study (Deliberation no.: DJUSKH-17-E-13-1). The data used in this study were collected through medical record observation and telephone survey (Appendix 1). The contents of the survey and questionnaire were performed according to the study of Jung et al [13] and considering advice from the professors at the department of Korean Medicine and department of Statistics at Daejeon University. The data collected were as follows.

Demographic characteristics

Gender, age, smoking history, drinking history, and occupation of the participants.

Disease characteristics

Diseases were classified into the following 3 categories.

- Disease 1: Cervical herniated disc, cervical spinal stenosis, lumbar herniated disc, lumbar spinal stenosis (If 2 diseases were present at the same time, they were classified based on the disease considered to be the most prevalent or serious disease).
- Disease 2: Cervical disease (cervical herniated disc, cervical spinal stenosis), lumbar disease (lumbar herniated disc, lumbar spinal stenosis).
- Disease 3: Herniated disc (cervical herniated disc, lumbar herniated disc), spinal stenosis (cervical spinal stenosis, lumbar spinal stenosis)

Disease duration was classified into 3 groups: Acute phase (within 4 weeks), Subacute phase (4 to 12 weeks), and Chronic phase (12 weeks or more) [13].

Therapeutic characteristics

The number of MSN treatments, Western medical treatment before or after MSN (injection or operation), discharge Numeric Rating Scale (NRS), existence of current pain or not, current NRS, existence of current treatment or not were analyzed. The degree of pain was analyzed using NRS [14]. There were 95 patients classified into the following 4 groups according to treatment method:

- Only treated with MSN
- Western medical treatment only (before MSN)
- Western medical treatment only (after MSN)
- Combination of Western medical treatment before and after MSN

Satisfaction characteristics

Satisfaction and intention of re-treatment with MSN was analyzed. Satisfaction consisted of 5 categories: very dissatisfied, somewhat dissatisfied, neutral, somewhat satisfied, very satisfied.

**Statistical analysis**

Statistical analysis was performed using IBM SPSS ver. 25.0. Frequency analysis and descriptive statistics for each characteristic were used to identify patients' characteristics. Crossover analysis using the Chi-square test was performed to determine the association between categorical variables. Independent *t* test and one-way analysis of variance (ANOVA) were used to determine the association between categorical variables and continuous variables. Multiple linear regression analysis was performed to analyze the factors affecting the continuous variables. Binary logistic regression analysis was performed to determine the factors affecting binary categorical groups.

## Results

### Frequency analysis and descriptive statistics

#### Demographic characteristics

A total of 95 subjects were surveyed with 46 males (48.4%) and 49 females (51.6%). There were 27 patients (28.4%) in their 50's, 23 patients (24.2%) in their 40's, and 20 patients (21.1%) in their 60's. The mean age of the patients was  $53.55 \pm 13.304$  years old. The youngest patient was 19 years old, and the eldest was 84 years old. There were 13 patients (13.7%) who were smokers and 82 patients (86.3%) were non-smokers. 18 patients (18.9%) answered that they had a history of drinking alcohol and 77 patients (83.7%) did not. 41 patients (43.2%) were unemployed, 32 patients (33.7%) were office workers, and 17 patients (17.9%) were workers in physical jobs (Table 1).

Table 1. Frequency Analysis and Descriptive Statistics of Demographic Characteristics.

Categories		N	%
Gender	Male	46	48.4
	Female	49	51.6
Age (y)	≤ 20's	4	4.2
	30's	9	9.5
	40's	23	24.2
	50's	27	28.4
	60's	20	21.1
	≥70's	12	12.6
Mean ± SD		53.55 ± 13.304	
Smoking history	Yes	13	13.7
	No	82	86.3
Drinking history	Yes	18	18.9
	No	77	81.1
Occupation	Unemployed	41	43.2
	Office worker	32	33.7
	Self-employed	4	4.2
	Physical worker	17	17.9
	Driver	1	1.1

Table 2. Frequency Analysis and Descriptive Statistics of Disease Characteristics.

Categories		N	%
Disease 1	Cervical herniated disc	17	17.9
	Cervical spinal stenosis	5	5.3
	Lumbar herniated disc	56	58.9
	Lumbar spinal stenosis	17	17.9
Disease 2	Cervical disease	22	23.2
	Lumbar disease	73	76.8
Disease 3	Herniated disc	73	76.8
	Spinal stenosis	22	23.2
Disease duration	Acute	15	15.8
	Subacute	23	24.2
	Chronic	57	60.0

#### Disease characteristics

There were 56 patients (58.9%) who had a lumbar herniated disc, 17 patients (17.9%) with cervical herniated discs, 17 patients (17.9%) with lumbar spinal stenosis, and 5 patients (5.3%) with cervical spinal stenosis. 22 patients (23.2%) had cervical disease, and 73 patients (76.8%) had lumbar disease. There were 73 patients (76.8%) who reported a herniated disc, and 22 patients (23.2%) had spinal stenosis. 57 patients (60.0%) were in the chronic phase, 23 patients (24.2%) were in the subacute phase, and 15 patients (15.8%) were in the acute phase (Table 2).

#### Therapeutic characteristics

The number of MSN treatments ranged from 1 to 22, with a mean number of MSN of  $5.80 \pm 4.753$ . There were 45 patients (47.4%) who received Western medical treatment before MSN, and 50 patients (52.6%) who did not. 22 patients (23.2%) received Western medical treatment after MSN, and 73 patients (76.8%) who did not. 38 patients (40.0%) were only treated with MSN without Western medical treatment, 36 patients (37.9%) received Western medical treatment only before MSN, 12 patients (12.6%) received Western medical treatment only after MSN, and 9 patients (9.5%) received Western medical treatment both before and after MSN. Discharge NRS ranged from 1 to 10, and the mean discharge NRS was  $5.23 \pm 2.860$ . Current NRS ranged from 0 to 9, and the mean current NRS was  $3.27 \pm 2.603$ . There were 69 patients (72.6%) with current pain, and 26 patients (27.4%) who were without current pain. 39 patients (41.1%) were under current treatment,

Table 3. Frequency Analysis and Descriptive Statistics of Therapeutic Characteristics.

Categories		N	%
Number of MSN	1-3	39	41.1
	4-6	24	25.3
	7-9	16	16.8
	10-12	5	5.3
	≥ 13	11	11.6
Mean ± SD		5.80 ± 4.753	
Western medical treatment before MSN	Yes	45	47.4
	No	50	52.6
Western medical treatment after MSN	Yes	22	23.2
	No	73	76.8
Treatment method	Only treated with MSN	38	40.0
	Western medical treatment only before MSN	36	37.9
	Western medical treatment only after MSN	12	12.6
	Western medical treatment both before and after MSN	9	9.5
Existence of current pain or not	Yes	69	72.6
	No	26	27.4
Existence of current treatment or not	Yes	39	41.1
	No	56	58.9
Discharge NRS	Mean ± SD	5.23 ± 2.860	
Current NRS	Mean ± SD	3.27 ± 2.603	

MSN, miniscalpel needle therapy; NRS, numeric rating scale.

and 56 patients (58.9%) were not (Table 3).

**Satisfaction characteristics**

There were 3 patients (3.2%) who answered that they were very dissatisfied about MSN treatment, 18 patients (18.9%) somewhat dissatisfied, 35 patients (36.8%) neutral, 23 patients (24.2%) somewhat satisfied, and 16 patients (16.8%) very satisfied. 54 patients (56.8%) had the intention of re-treatment with MSN, and 41 patients (43.2%) who did not (Table 4).

**Crossover analysis**

**Treatment method**

There was a significant difference in the treatment methods according to gender as a result of the crossover analysis using the Chi-square test to determine the relationship between treatment methods and gender, age, smoking history, drinking history, occupation, disease 1, disease 2, disease 3, and disease duration ( $p < 0.05$ ).

For females, the percentage belonging to the group who received Western medical treatment only before MSN (22 patients, 44.9%) was higher than that of males (14 patients, 30.4%). For males, the percentage belonging to the group who received Western medical treatment both before and after MSN (8 patients, 17.4%) was higher than that of females (1 patient, 2.0%) shown in Table 5.

Table 4. Frequency Analysis and Descriptive Statistics of Satisfaction Characteristics.

Categories		N	%
Satisfaction of MSN	Very dissatisfied	3	3.2
	Somewhat dissatisfied	18	18.9
	Neutral	35	36.8
	Somewhat satisfied	23	24.2
	Very satisfied	16	16.8
Intention of re-treatment with MSN	Yes	54	56.8
	No	41	43.2

MSN, miniscalpel needle therapy.

Table 5. Crossover Analysis of Treatment Method and Gender.

Categories		Group classified as treatment method				Total	$\chi^2$	
		Only MSN	WMT MSN	MSN WMT	WMT MSN WMT			
Gender	Male	N	17	14	7	8	7.890*	
		%	37.0	30.4	15.2	17.4		
	Female	N	21	22	5	1		49
		%	42.9	44.9	10.2	2.0		100.0
Total	N	38	36	12	9	95		
	%	40.0	37.9	12.6	9.5	100.0		

\* $p < 0.05$ .  
 MSN, miniscalpel needle therapy; MSN, WMT only before MSN; Only MSN, only treated with MSN WMT; MSN WMT, WMT only after MSN WMT MSN; WMT, western medical treatment; WMT, WMT both before and after MSN.

**Current pain**

There was a significant difference in the current pain score according to disease duration following crossover analysis using the Chi-square test to determine the relationship between current pain and gender, age, smoking history, drinking history, occupation, disease 1, disease 2, disease 3, disease duration, and treatment methods ( $p < 0.01$ ).

The percentage of patients who had current pain among patients treated with MSN in the acute phase (13 patients, 86.6%), was higher than that of the subacute (11 patients, 47.8%) and chronic (45 patients, 78.9%) phase (Table 6).

**Current treatment**

As a result of the crossover analysis using the Chi-square test to determine the relationship between current treatment and gender, age, smoking history, drinking history, occupation, disease 1, disease 2, disease 3, disease duration, and treatment methods, there was no statistically significant difference.

**Satisfaction of MSN**

As a result of the crossover analysis using the Chi-square test to determine the relationship between satisfaction of MSN and gender, age, smoking history, drinking history, occupation, disease 1, disease 2, disease 3, disease duration, and treatment methods, there were significant differences in the satisfaction with MSN according to disease duration ( $p < 0.01$ ), and treatment methods ( $p < 0.001$ ). The percentage of patients who answered as neutral in the chronic phase group (29 patients, 50.9%) was higher than that of acute (2 patients, 13.3%) and subacute (4 patients, 17.4%) phase groups. The percentage of patients who answered as “somewhat satisfied” in the group that was treated with MSN only (14 patients, 36.8%) was higher than that of others, and the percentage of patients of somewhat dissatisfied in group who received Western medical treatment both before and after MSN (5 patients, 55.6%) was higher than that of the others (Table 7).

**Intention of re-treatment with MSN**

As a result of the crossover analysis using the Chi-square test to determine the relationship between intention of re-treatment with MSN and gender, age, smoking history, drinking history, occupation, disease 1, disease 2, disease 3, disease duration, and treatment methods, there was a significant difference in

Table 6. Crossover Analysis of Current Pain and Disease Duration.

Categories		Existence of current pain or not		Total	$\chi^2$
		Yes	No		
Acute	N	13	2	15	
	%	86.6	13.4	100.0	
Subacute	N	11	12	23	9.750**
	%	47.8	52.2	100.0	
Chronic	N	45	12	57	
	%	78.9	21.1	100.0	
Total	N	69	26	95	
	%	72.6	27.4	100.0	

\*\* $p < 0.01$ .

Table 7. Crossover Analysis of Satisfaction of MSN and Disease Duration, Number of MSN, Treatment Method.

Categories			Satisfaction of MSN					Total	$\chi^2$
			VD	SD	NE	SS	VS		
Disease duration	Acute	N	1	1	2	8	3	15	20.329**
		%	6.7	6.7	13.3	53.3	20.0	100.0	
	Subacute	N	1	8	4	6	4	23	
		%	4.3	34.8	17.4	26.1	17.4	100.0	
	Chronic	N	1	9	29	9	9	57	
		%	1.7	15.8	50.9	15.8	15.8	100.0	
Treatment method	Only MSN	N	0	5	12	14	7	38	34.990***
		%	0.0	13.2	31.6	36.8	18.4	100.0	
	WMT MSN	N	0	6	16	7	7	36	
		%	0.0	16.7	44.5	19.4	19.4	100.0	
	MSN WMT	N	3	2	5	1	1	12	
		%	25.0	16.7	41.7	8.3	8.3	100	
	WMT MSN WMT	N	0	5	2	1	1	9	
		%	0.0	55.6	22.2	11.1	11.1	100.0	
Total	N	3	18	35	23	16	95		
	%	3.3	18.9	36.8	24.2	16.8	100.0		

\*\* $p < 0.01$ . \*\*\* $p < 0.001$ .

NE, neutral; SD, somewhat dissatisfied; SS, somewhat satisfied; VD, very dissatisfied; VS, very satisfied; MSN, miniscalpel needle therapy; MSN, WMT only before MSN; Only MSN, Only treated with MSN WMT; MSN WMT, WMT only after MSN WMT MSN; WMT, western medical treatment; WMT, WMT both before and after MSN.

Table 8. Crossover Analysis of Intention of Re-treatment with MSN and Treatment Method.

Categories			Intention of re-treatment with MSN		Total	$\chi^2$
			Yes	No		
Treatment method	Only MSN	N	24	14	38	9.135*
		%	63.2	36.8	100.0	
	WMT MSN	N	24	12	36	
		%	66.7	33.3	100.0	
	MSN WMT	N	4	8	12	
		%	33.3	66.7	100.0	
	WMT MSN WMT	N	2	7	9	
		%	22.2	77.8	100.0	
Total	N	54	41	95		
	%	56.8	43.2	100.0		

\* $p < 0.05$ .

MSN, miniscalpel needle therapy; MSN, WMT only before MSN; Only MSN, only treated with MSN WMT; MSN WMT, WMT only after MSN WMT MSN; WMT, western medical treatment; WMT, WMT both before and after MSN.

the intention of re-treatment with MSN according to treatment methods ( $p < 0.05$ ).

The percentage of patients who did not intend to have re-treatment with MSN in the group who received Western medical treatment both before and after MSN (7 patients, 77.8%) was higher than that of others. The percentage of patients who intended to have re-treatment with MSN in groups of Western medical treatment only before MSN (24 patients, 66.7%) and only treated with MSN (24 patients, 63.2%), were higher than that of others (Table 8).

### Independent t test and one-way ANOVA

#### Discharge NRS

As a result of the Independent *t* test to determine the relationship between discharge NRS and gender, smoking history, drinking history, disease 2, and disease 3, there was no statistically significant differences found. As a result of the one-way ANOVA to determine the relationship between discharge NRS and age, occupation, disease 1, and disease duration, there was no significant difference statistically.

#### Current NRS

As a result of the Independent *t* test to determine the relationship between current NRS and gender, smoking history, drinking history, disease 2, and disease 3, there was no significant difference statistically. As a result of the one-way ANOVA to determine the

Table 9. One-way ANOVA of Current NRS and Disease Duration.

Categories		Current NRS			F	p	Duncan
		N	Mean	SD			
Disease duration	Acute <sup>a</sup>	15	3.00	1.890	4.609	0.012*	c > b, a
	Subacute <sup>b</sup>	23	2.00	2.486			
	Chronic <sup>c</sup>	57	3.86	2.649			

\*p < 0.05.  
NRS, numeric rating scale.

Table 10. Independent t test of Difference Between Discharge and Current NRS and Disease.

Categories		Difference between discharge and current NRS			T
		N	Mean	SD	
Disease	Herniated disc	73	1.60	2.686	-2.381*
	Spinal stenosis	22	3.14	2.513	

\*p < 0.05.  
NRS, numeric rating scale.

Table 11. Independent t test of Number of MSN and Disease.

Categories		Number of MSN			T
		N	Mean	SD	
Disease	Cervical disease	22	7.91	5.494	2.436*
	Lumbar disease	73	5.16	4.349	

\*p < 0.05.  
NRS, numeric rating scale.

Table 12. One-way ANOVA of Number of MSN and Disease.

Categories		Number of MSN			F	p	Duncan
		N	Mean	SD			
Disease	Cervical herniated disc <sup>a</sup>	17	8.53	5.875	4.728	0.004**	a > c, b, d
	Cervical Spinal stenosis <sup>b</sup>	5	5.80	3.633			
	Lumbar herniated disc <sup>c</sup>	56	4.43	3.717			
	Lumbar Spinal stenosis <sup>d</sup>	17	7.59	5.432			

\*\*p < 0.01.  
NRS, numeric rating scale.

relationship between current NRS and age, occupation, disease 1, disease duration, and treatment methods, there was a significant difference in the current NRS according to disease duration ( $p < 0.05$ ). The mean of current NRS in the chronic phase group (3.86) was higher than that of the subacute phase group (2.00) shown in Table 9.

Difference between discharge and current NRS (NRS upon discharge-current NRS)

As a result of the Independent *t* test to determine the relationship between difference between discharge and current NRS and gender, smoking history, drinking history, disease 2, and disease 3, there were significant differences between discharge and current NRS according to disease 3 ( $p < 0.05$ ). The mean difference between discharge and current NRS in the spinal stenosis group (3.14) was higher than that in the herniated disc group (1.60) (Table 10).

As a result of the one-way ANOVA to determine the relationship between discharge and current NRS and age, occupation, disease 1, disease duration, and treatment methods, there was no significant difference statistically.

Number of MSN

As a result of the Independent *t* test to determine the relationship between the number of MSN and gender, smoking history, drinking history, disease 2, and disease 3, there was a significant difference in the number of MSN according to disease 2 ( $p < 0.05$ ). The mean number of MSN in the cervical disease group (7.91) was higher than that of the lumbar disease group (5.16) shown in Table 11.

As a result of the one-way ANOVA to determine the relationship between number of MSN and age, occupation, disease 1, and disease duration, there was a significant difference in the number of MSN according to disease 1 ( $p < 0.01$ ). The mean of number of MSN in the cervical herniated disc group (8.53) was higher than that of the lumbar herniated disc (4.43) (Table 12).

*Multiple linear regression analysis*

Discharge NRS

The multiple linear regression analysis determined that the variables affecting discharge NRS, were identified as a suitable model ( $F = 2.526, p < 0.05$ ). The independent variables statistically

Table 13. Multiple Linear Regression Analysis of Discharge NRS.

Categories	Unstandardized		Standardized	<i>t</i>	<i>p</i>	F
	<i>B</i>	SE	beta			
Constant	2.017	1.666		1.211	0.229	
Gender	-0.475	0.619	-0.084	-0.766	0.446	
Age (y)	0.047	0.023	0.214	2.014	0.047*	
Smoking history	-0.511	0.992	-0.060	-0.515	0.608	2.526*
Drinking history	1.161	0.857	0.158	1.355	0.179	
Disease duration	0.845	0.387	0.225	2.181	0.032*	
Number of MSN	-0.127	0.061	-0.214	-2.101	0.039*	
Dependent variable: Discharge NRS						

\**p* < 0.05.

MSN, miniscalpel needle therapy; NRS, numeric rating scale; SE, standard error.

Table 14. Multiple Linear Regression Analysis of Current NRS.

Categories	Unstandardized		Standardized	<i>t</i>	<i>p</i>	F
	<i>B</i>	SE	beta			
Constant	2.429	1.456		1.669	0.099	
Gender	-0.531	0.553	-0.105	-0.962	0.339	
Age (y)	0.019	0.020	0.099	0.953	0.344	
Smoking history	-1.688	0.862	-0.233	-1.959	0.053	2.847*
Drinking history	0.122	0.749	0.019	0.162	0.871	
Disease duration	0.677	0.339	0.203	1.997	0.049*	
Number of MSN	-0.162	0.058	-0.285	-2.803	0.006*	
Dependent variable: Current NRS						

\**p* < 0.05.

MSN, miniscalpel needle therapy; NRS, numeric rating scale; SE, standard error.

affecting discharge NRS were age (unstandardized *B* = 0.047, *p* < 0.05), disease duration (unstandardized *B* = 0.845, *p* < 0.05), and number of MSN (unstandardized *B* = -0.127, *p* < 0.05). In other words, as the age, and disease duration increased by 1 unit, the discharge NRS increased each by 0.047 and 0.845, respectively, and as the number of MSN increased by 1 unit, the discharge NRS decreased by 0.127 (Table 13).

#### Current NRS

From multiple linear regression analysis, the variables affecting current NRS, were identified as a suitable model (*F* = 2.847, *p* < 0.05). The independent variables statistically affecting current NRS were disease duration (unstandardized *B* = 0.677, *p* < 0.05), and number of MSN (unstandardized *B* = -0.162, *p* < 0.01). In other words, as the disease duration increased by 1 unit, the current NRS increased by 0.677, and as the number of MSN increased by 1 unit, the current NRS decreased by 0.162 (Table 14).

#### Difference between discharge and current NRS

Multiple linear regression analysis to determine the variables affecting difference between discharge and current NRS, showed

this was an unsuitable model (*F* = 1.374, *p* = 0.234), and there were no statistically significant variables.

#### Satisfaction of MSN

The multiple linear regression analysis determined that the variables affecting satisfaction of MSN, were identified as a suitable model (*F* = 4.600, *p* < 0.001). The independent variables statistically affecting the satisfaction of MSN were Western medical treatment after MSN (unstandardized *B* = -0.758, *p* < 0.01), discharge NRS (unstandardized *B* = -0.099, *p* < 0.05), and current NRS (unstandardized *B* = -0.099, *p* < 0.05). In other words, the more the patients did not receive Western medical treatment after MSN, the more they were satisfied with MSN, and as the discharge NRS and current NRS increased by 1 unit, the satisfaction of MSN decreased by 0.099 (Table 15).

#### Binary logistic regression analysis

##### Existence of current pain

As a result of the binary logistic regression analysis to determine the variables affecting the existence of current pain, the

Table 15. Multiple Linear Regression Analysis of Satisfaction of MSN.

Categories	Unstandardized		Standardized	t	p	F
	B	SE	beta			
Independent variable	Constant	4.404	0.565		7.799	0.000
	Gender	-0.307	0.211	-0.147	-1.451	0.151
	Age (y)	0.006	0.008	0.071	0.732	0.466
	Smoking history	-0.100	0.346	-0.032	-0.290	0.773
	Drinking history	0.270	0.290	0.102	0.930	0.355
	Disease duration	-0.046	0.132	-0.033	-0.351	0.726
	Number of MSN	0.027	0.021	0.121	1.287	0.202
	WMT before MSN	0.082	0.191	0.039	0.427	0.670
	WMT after MSN	-0.758	0.235	-0.304	-3.231	0.002**
	Discharge NRS	-0.099	0.042	-0.266	-2.351	0.021*
	Current NRS	-0.099	0.044	-0.246	-2.228	0.029*
	Dependent variable: Satisfaction of MSN					

\*p < 0.05. \*\*p < 0.01. \*\*\*p < 0.001.  
 MSN, miniscalpel needle therapy; NRS, numeric rating scale; SE, standard error; WMT, western medical treatment.

Table 16. Binary Logistic Regression Analysis of Current Pain.

Categories	B	SE	Wald	p	Exp (B)		
Gender	0.317	0.639	0.246	0.620	1.373		
Age (y)	-0.012	0.023	0.257	0.612	0.988		
Smoking history	-0.774	0.897	0.744	0.388	0.461		
Drinking history	-0.563	0.769	0.537	0.464	0.569		
Independent variable	Disease	Cervical herniated disc	-0.341	0.860	0.157	0.692	0.711
		Cervical spinal stenosis	20.000	17671.747	0.000	0.999	484963419.347
		Lumbar herniated disc	0.806	0.832	0.940	0.332	2.240
		Lumbar spinal stenosis			2.701	0.440	
Disease duration	-0.044	0.370	0.014	0.905	0.957		
Number of MSN	-0.023	0.060	0.153	0.696	0.977		
Treatment method	Only MSN	0.786	0.911	0.746	0.388	2.195	
	WMT MSN	1.014	0.939	1.167	0.280	2.757	
	MSN WMT	1.150	1.203	0.914	0.339	3.159	
	WMT MSN WMT			1.341	0.720		
Discharge NRS	0.262	0.105	6.196	0.013*	1.299		
Constant	-0.925	2.172	0.181	0.670	0.397		
Dependent variable: Current pain							

\*p < 0.05.  
 MSN, miniscalpel needle therapy; MSN, WMT only before MSN; NRS, numeric rating scale; Only MSN, only treated with MSN WMT; MSN WMT, WMT only after MSN WMT MSN; SE, standard error; WMT, western medical treatment; WMT, WMT both before and after MSN.



Table 17. Binary Logistic Regression Analysis of Intention of Re-treatment with MSN.

Categories		B	SE	Wald	p	Exp (B)	
Independent variable	Gender	-1.402	0.664	4.464	0.035*	0.246	
	Age (y)	0.002	0.023	0.008	0.928	1.002	
	Smoking history	-1.173	1.065	1.214	0.271	0.309	
	Drinking history	1.130	0.860	1.726	0.189	3.096	
	Disease	Cervical herniated disc	-0.573	0.926	0.383	0.536	0.564
		Cervical spinal stenosis	0.286	1.193	0.058	0.810	1.331
		Lumbar herniated disc	-0.032	0.811	0.002	0.968	0.968
		Lumbar spinal stenosis			0.717	0.869	
	Disease duration	0.251	0.381	0.432	0.511	1.285	
	Number of MSN	0.049	0.058	0.706	0.401	1.050	
	Treatment method	Only MSN	3.445	1.282	7.221	0.007**	31.333
		WMT MSN	3.739	1.335	7.848	0.005**	42.036
		MSN WMT	2.280	1.425	2.560	0.110	9.775
		WMT MSN WMT			9.688	0.021**	
Discharge NRS	-0.336	0.116	8.421	0.004**	0.715		
Constant	0.141	2.345	0.004	0.952	1.151		

Dependent variable: Intention of re-treatment with MSN

\* $p < 0.05$ . \*\* $p < 0.01$ .

MSN, miniscalpel needle therapy; MSN, WMT only before MSN; NRS, numeric rating scale; Only MSN, only treated with MSN WMT; MSN WMT, WMT only after MSN WMT MSN; SE, standard error; WMT, western medical treatment; WMT, WMT both before and after MSN.

independent variable statistically significantly affecting current pain was discharge NRS ( $B = 0.262$ ,  $\text{Exp (B)} = 1.299$ ,  $p < 0.05$ ). In other words, as the discharge NRS increased by 1 unit, the odds ratio of existence of current pain increased by 1.299 times (Table 16).

#### Current treatment

Binary logistic regression analysis was performed to determine the variables affecting current treatment, showing that there were no statistically significant variables.

#### Intention of retreatment with MSN

As a result of the binary logistic regression analysis to determine the variables affecting intention of retreatment with MSN, the independent variables statistically affecting the intention of retreatment with MSN were gender ( $B = -1.402$ ,  $\text{Exp (B)} = 0.246$ ,  $p < 0.05$ ) and discharge NRS ( $B = -0.336$ ,  $\text{Exp (B)} = 0.715$ ,  $p < 0.01$ ). Comparisons with Western medical treatment both before and after MSN, showed that there were statistically significant differences compared with groups treated only with MSN ( $B = 3.445$ ,  $\text{Exp (B)} = 31.333$ ,  $p < 0.01$ ) and patients treated with Western medicine only before MSN ( $B = 3.739$ ,  $\text{Exp (B)} = 42.036$ ,  $p < 0.01$ ). In other words, when compared with males, the odds ratio of intention of re-treatment with MSN of female decreased by 0.246 times, and as

the discharge NRS increased by 1 unit, the odds ratio of intention of re-treatment with MSN decreased by 0.715 times. When compared with Western medical treatment both before and after MSN, the odds ratio of intention of re-treatment with MSN in groups only treated with MSN, and treated with Western medicine only before MSN, increased by 31.333 times and 42.036 times each, respectively (Table 17).

#### Discussion

Miniscalpel needle (MSN) therapy is a combination of traditional acupuncture theory and Western medical surgical treatment. It is a treatment strategy that treats chronic pain caused by adhesion of soft tissue through peeling, and provides smooth blood circulation and local recovery to the damaged tissue [7]. It is used for several diseases, mainly for musculoskeletal diseases [8-12]. However, there are few studies examining the factors that affect prognosis, their correlation, and satisfaction of MSN for herniated intervertebral disc (HIVD) or spinal stenosis patients treated with MSN. Therefore, it is necessary to analyze the factors affecting prognosis and characteristics of patients treated with MSN for HIVD or spinal stenosis.

In this study, 95 patients who were admitted to the Dunsan Korean medicine hospital of Daejeon University from January 01,

2016 to September 30, 2017 were investigated for the treatment of herniated intervertebral disc or spinal stenosis with MSN. Demographic characteristics were assessed including gender, age, smoking history, drinking history, and occupation, and characteristics of disease, and disease duration, and therapeutic characteristics including number of MSN, Western medical treatment before or after MSN (injection or operation), discharge NRS, existence of current pain, current NRS, and existence of current treatment, and satisfaction characteristics including satisfaction of MSN, and intention of re-treatment with MSN.

Amongst the 6,511 patients admitted to Dunsan Korean medicine hospital of Daejeon University, 1,306 patients were admitted to the department of Acupuncture and Moxibustion. Patients treated with MSN for HIVD or spinal stenosis were selected, with uncontactable or dead patients excluded from the study. As a result, a total of 95 patients were investigated. There were 46 males (48.4%) and 49 females (51.6%), respectively. The mean age of patients was 53.55 years old and the largest group was patients in their 50's (27 patients, 28.4%). Most of the patients were in their 40's to 60's, accounting for about 73.7% of the total. This finding seems to be similar to the results of studies where the herniated disc herniation mostly occurred in patients in their 30's to 50's and spinal stenosis in patients in their 50's to 60's [15,16].

The largest disease group was lumbar herniated disc (56 patients, 58.9%), followed by cervical herniated disc and lumbar spinal stenosis (17 patients each, 17.9%), so MSN was used most commonly for lumbar herniated disc. However, this may be due to the high rate of lumbar herniated disc among inpatients in Korean medicine hospital or Department of Acupuncture and Moxibustion [1-5]. Therefore, further research seems to be needed to determine the relationship between specific diseases and MSN.

Analysis of disease duration showed that the largest group of patients occurred in the chronic phase (57 patients, 60.0%), followed by subacute (23 patients, 24.2%), and acute phase (15 patients, 15.8%), so MSN was mainly used in chronic pain patients, which was probably linked to the high rate of chronic pain patients.

The results of investigation in therapeutic characteristics showed that the group treated only with MSN (38 patients, 40.0%) and the group treated with Western medicine before MSN (36 patients, 37.9%) accounted for the majority. The results from this study indicate that in patients treated with MSN, they will be less likely to receive Western medical treatment later, suggesting that MSN may be considered as an alternative to Western medical treatment as 1 of the conservative treatment strategies of Korean Medicine.

The results of investigation in satisfaction characteristics showed that patients were mostly satisfied with MSN. Further studies on the satisfaction of MSN through survey with additional items such as reason for responding with satisfaction or dissatisfaction, or requirements for improvement are needed.

Crossover analysis using the Chi-square test, Independent *t* test, one-way ANOVA, multiple linear regression analysis, and binary logistic regression analysis were conducted to analyze the relationship between each characteristic. Crossover analysis was conducted to investigate the relationship between categorical variables such as gender, age, smoking history, drinking history, occupation, disease, disease duration, treatment method, existence of current pain, existence of current treatment, satisfaction of MSN, and intention of re-treatment with MSN. Independent *t* test and one-way ANOVA were conducted to determine the relationship between categorical variables such as gender, age, smoking history, drinking history, occupation, disease, disease duration, and treatment methods and continuous variables such as discharge NRS, current NRS, difference between discharge and

current NRS, and number of MSN. Multiple linear regression analysis was conducted to investigate the variables affecting continuous variables such as discharge NRS, current NRS, difference between discharge and current NRS, and satisfaction of MSN. Binary logistic regression analysis was conducted to determine the variables affecting the binary categorical variables such as existence of current pain, existence of current treatment, and intention of re-treatment with MSN.

The results of the crossover analysis using the Chi-square test showed that there was a difference in the treatment methods according to gender. There was a greater proportion of females belonging to the group that received Western medical treatment only before MSN (22 patients, 44.9%) than males (14 patients, 30.4%). In contrast, more males, were in the group who received Western medical treatment both before and after MSN (8 patients, 17.4%) than females (1 patient, 2.0%). In other words, males tended to receive more Western medical treatment after MSN than females.

In addition, there was a difference in the incidence of patients experiencing current pain according to their disease duration group. The percentage of patients who had current pain among patients treated with MSN in acute phase (13 patients, 86.6%) was higher than that of the subacute (11 patients, 47.8%) and chronic phase (45 patients, 78.9%). Therefore, it seems to be more efficient to treat with MSN in the chronic phase rather than in the acute phase. In the acute phase, it is considered more effective to administer treatments other than MSN.

There were differences in the satisfaction and intention of re-treatment with MSN according to disease duration, and treatment methods. The percentage of patients who answered as neutral in the chronic phase group (29 patients, 50.9%) was higher than that in the acute (2 patients, 13.3%) and subacute phase groups (4 patients, 17.4%). Considering that patients in the chronic phase group (57 patients, 60.0%) showed the highest number of patients treated with MSN, improving the satisfaction of the patients in the chronic phase group should be considered. The percentage of patients who were somewhat satisfied in the group treated with MSN only (14 patients, 36.8%), was higher than that of others, and the percentage of patients who were somewhat dissatisfied in the group who received Western medical treatment both before and after MSN (5 patients, 55.6%) was higher than that of others. Furthermore, the percentage of patients who did not have intention of re-treatment with MSN in the group that received Western medical treatment both before and after MSN (7 patients, 77.8%) was higher than that of others. The percentage of patients who had intention of re-treatment with MSN in the groups who received Western medical treatment only before MSN (24 patients, 66.7%) and only treated with MSN (24 patients, 63.2%), were higher than that of others. In other words, it seems that minimizing Western medical treatment and applying MSN treatment has a beneficial effect, and therefore satisfaction and intention of re-treatment with MSN are also improved.

The results of the Independent *t* test and one-way ANOVA showed there was a difference in the current NRS according to disease duration. The mean of current NRS in the chronic phase group (3.86), was higher than that of the subacute phase (2.00). Therefore, if the MSN is administered in the subacute phase, it may reduce pain in the future and prevent progression to chronic phase.

In addition, there was a difference between discharge and current NRS according to disease 3. The mean difference between discharge and current NRS in the spinal stenosis group (3.14) was higher than that in the herniated disc group (1.60). Therefore, among patients treated with MSN, patients with spinal stenosis showed a greater decrease in current pain compared to pain upon

discharge than in patients with a herniated disc. However, this is a consequence of other unconsidered factors, so further studies on the relationship between disease and NRS reduction are needed.

There were differences in the number of MSN according to disease 1 and 2. The mean number of MSN in the cervical disease group (7.91) was higher than that in the lumbar disease group (5.16), and the mean of number of MSN in the cervical herniated disc group (8.53) was higher than that in the lumbar herniated disc group (4.43). Based on this data, it would be more efficient to explain to patients the characteristics of the treatment region before performing MSN, and it could be used for the calculation of the number of MSN according to disease and region.

The results of the multiple linear regression analysis indicated that as the age, and disease duration increased by 1 unit, the discharge NRS increased each by 0.047 and 0.845, and as the number of MSN increased by 1 unit, the discharge NRS decreased by 0.127. As the disease duration increased by 1 unit, the current NRS increased by 0.677, and as the number of MSN increased by 1 unit, the current NRS decreased by 0.162. Furthermore, the more the patients did not receive Western medical treatment after MSN, the more satisfied the patients were with MSN treatment, and as the discharge NRS and current NRS increased by 1 unit, the satisfaction of MSN decreased by 0.099. In other words, the longer the disease duration, the fewer the number of MSN and greater discharge and current NRS. Furthermore, as the discharge and current NRS increases, the satisfaction of MSN decreases. Therefore, it is suggested that maximizing the number of MSN treatments within the appropriate range before chronic development of the disease, helps to reduce the pain immediately after treatment. In the future, this may increase satisfaction with MSN treatment.

The results of the binary logistic regression analysis showed that when discharge NRS increased by 1 unit, the odds ratio of current pain increased by 1.299 times. When compared with male patients, the odds ratio of intention of re-treatment with MSN in female patients decreased by 0.246 times, and as the discharge NRS increased by 1 unit, the odds ratio of intention of re-treatment with MSN decreased by 0.715 times. When compared with Western medical treatment both before and after MSN, the odds ratio of intention of re-treatment with MSN in groups treated with MSN only or treated with Western medicine only before MSN, increased by 31.333 times and 42.036 times, respectively. Therefore, in order to increase the patients motivation for re-treatment with MSN, it is important to reduce the discharge NRS through aggressive Korean medical treatment as well as MSN during admission. Female patients may be relatively more sensitive to the pain felt during MSN, so the motivation for re-treatment with MSN seems to be less than in males. Moreover, as confirmed in the crossover analysis, it seems that this data can be used to increase the effectiveness of MSN, minimizing Western medical treatment, and increasing the motivation for re-treatment with MSN in groups treated only with MSN and treated with Western medicine only before MSN, which is relatively higher than other groups.

This study was performed on patients who were admitted to Dunsan Korean medicine hospital of Daejeon University from January 01, 2016 to September 30, 2017, for the treatment of herniated disc or spinal stenosis with MSN, and the purpose of this study was to evaluate the characteristics, prognosis, current status of patients, variables affecting prognosis, and their relationship through retrospective statistical analysis. This study is meaningful in prognostic analysis of large-scale participants for MSN and statistical analysis of variables affecting the prognosis and satisfaction. It can be used as the basis for treatment with MSN, patient consultation related to MSN, and development of

standardized MSN medical treatment guidelines. However, this study has some limitations. This is a retrospective study based on data collected on medical records and patient statements rather than a prospective study designed using control groups. Detailed treatment methods such as other Korean medical treatments apart from MSN were not controlled. Further studies of multi-center, large-scale prospective randomized control with long-term, systematic observations are needed.

## Conclusion

Demographic characteristics, disease characteristics, therapeutic characteristics, and satisfaction characteristics were investigated in patients who were admitted to Dunsan Korean medicine hospital of Daejeon University from January 01, 2016 to September 30, 2017, for the treatment of herniated disc or spinal stenosis with MSN, and analyzed statistically. The results were as follows.

- As a result of the crossover analysis using the Chi-square test, there were differences in the treatment methods according to gender, current pain according to disease duration, satisfaction of MSN according to disease duration, and intention of re-treatment with MSN according to treatment methods.

- As a result of the Independent *t* test and one-way ANOVA, there was a difference in the current NRS according to disease duration, between discharge and current NRS, and the number of MSN according to disease.

- As a result of the multiple linear regression analysis, the independent variables statistically affecting discharge NRS were age, disease duration, and number of MSN, affecting current NRS were disease duration, and number of MSN, and affecting satisfaction of MSN were Western medical treatment after MSN, discharge NRS, and current NRS.

- As a result of the binary logistic regression analysis, the independent variable statistically affecting current pain was discharge NRS, and affecting intention of re-treatment with MSN were gender, discharge NRS, and treatment methods.

## Conflicts of Interest

The authors have no conflicts of interest to declare.

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**Appendix 1. Questionnaire.**

	<p>A telephone questionnaire to check the current status of patients who were admitted for the treatment of herniated intervertebral disc or spinal stenosis with MSN</p>	<p>October 2017</p>
<p>Script for telephone survey after discharge</p>		
<p>Hello? This is department of acupuncture and moxibustion at Dunsan Korean medicine hospital of Daejeon University. Are you OO who received MSN for OO disease OO (month), OO (year)?</p> <p>We are doing a telephone survey for check-up and symptom managements of patients who received MSN. Listen to my question and please answer according to your current status. Let me begin now.</p> <p>1. Have you ever been to a hospital or clinic of orthopedics, neurosurgery, or pain medicine after discharge? (Yes / No)</p> <p>2. Are you still having pain or radiating pain? Yes (-&gt;2-1), No (-&gt;3).</p> <p>2-1. If 0 means no pain, 5 means moderate pain, and 10 means very severe pain, my current pain is about ....</p> <p>2-2. Have you ever had back pain or lower back pain in the last month and have been treated more than twice a week? (Yes / No)</p> <p>3. How satisfied were you with the MSN treatment?</p> <p>① very dissatisfied ② somewhat dissatisfied ③ neutral ④ somewhat satisfied ⑤ very satisfied</p> <p>4. Are you willing to receive MSN treatment again at the time of the pain recurrence? (Yes / No)</p> <p>Thank you very much. The telephone survey is finished. Once a pain occurred, recurrence is very often, so steady management is necessary. You also visit us for treatment again.</p> <p>Thank you again for answering to our survey.</p> <p>(October, 2017)</p>		