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Original Article

The Effects of Magnetic Stimulation Therapy on Nursing Home Residents with Sleep Disturbance

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SUMMARY

Background: Nursing home residents often experience sleep disorders, along with physical, emotional, and cognitive problems. This study aimed to investigate the effect of magnetic stimulation therapy (MST) for nursing homes residents with sleep disturbances.
Methods: This quasi-experimental study used a crossover design. Group I (n = 20) received MST for 2 weeks using low-intensity magnetic fields (100 Gauss) and then received routine care after a wash-out period. Group II (n = 18) conversely received routine care and MST later. Objective sleep quality was examined using a wearable device to measure sleep architecture before and after each intervention.
Results: The average age of the participants was 84.3 years. After MST, there was a significant increase in total sleep time (t = 4.91, p < 0.001), total bed time (t = 4.58, p < 0.001), number of wakes after sleep onset (t = 2.87, p = 0.007), rapid eye movement time (t = 5.09, p < 0.001), percent of rapid eye movement (t = 4.01, p < 0.001) and non-rapid eye movement stage 1, 2 (t = 3.05, p = 0.004).
Conclusion: This study had shown that MST was an effective method to improve the objective sleep quality of nursing home residents with sleep disturbance. Therefore, MST is recommended to conduct a routine intervention to evaluate the long-term effects for nursing home residents.

1. Introduction

More than 50% of older adults complain about sleep disorders, and sleep quality is lower for older adults in nursing homes who have relatively more underlying diseases than those living in the community.[1] Because sleep disorders can be affected by age, sex, cognitive impairment, depression,[2,3] activities of daily living,[4] medication,[5] and comorbidities,[3] effective sleep interventions should consider these factors to improve sleep quality in nursing home residents.

As an alternative to sedatives or supplementary drugs such as melatonin, complementary and alternative therapies have been developed and applied to improve sleep quality. Magnetic stimulation therapy (MST) combines acupressure and magnetic therapy and stimulates specific meridians with magnetic fields, resulting in physiological changes in sleep by stimulating the nervous system through the potential along the surface of the skin.[6–8] Acupressure therapy is a non-invasive therapy that applies pressure to body points with the hands[9–11] or wrists[12,13] to improve sleep quality in older adults with sleep disorders. In previous studies of acupressure, time and duration varied depending on the study, although the heart meridian (HT7) was the main point for sleep.[10–13]

Sleep intervention effects were often assessed by subjective satisfaction, but intervention effects should be evaluated objectively as well.[8] Wearable devices with high sensitivity and accuracy have been used recently to simplify the evaluation of sleep architecture, including rapid eye movement (REM) and non-rapid eye movement (NREM) for shallow (stages 1 and 2), and deep (stage 3) sleep.[14] Objective sleep quality can be considered of high quality when each stage has adequate duration and intensity.

Therefore, this study aimed to apply MST therapy with older adults with sleep disturbance in nursing homes in order to determine the effect of MST on improving objective sleep quality using a wearable sleep device after adjusting for potential covariates.

2. Materials and methods

2.1. Study participants

Study participants were older adults aged 65 years or older with sleep disturbance at two nursing homes in South Korea between August 17, 2020 and October 31, 2020.

The number of samples was based on the PASS 16.0.4 program (Number Cruncher Statistical System, Utah, USA), which was used to obtain the minimum sample size required for the crossover design. Considering the effect size range from previous studies was 0.195 to 1.237,[9] we determined an effect size of 0.70 for this study. Based on calculations with a significance level of 0.05 and a power of 0.80, a minimum of 34 participants was required. When factoring in a 20% dropout rate,[9] the total number of participants required was 44.

A recruitment notice was posted in the elevators and distributed during day programs and mealtimes. The researchers also

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provided advance notice that patients with pacemakers, stents, heart valve surgery, or metals attached to their body would be excluded.[11,15] As a result, out of the 90 participants who expressed interest, 74 were included in pre-screening tests. The 44 potential participants were selected using sleep disorder criteria of under 6.5 hours of total sleep time[16] and under 17% of REM (%)[17] when using a Fitbit. They were assigned to Groups I and II depending on their nursing home. The final sample included 20 (87%) and 18 (86%) participants in Group I and Group II, respectively (Figure 1).

2.2. Study design and intervention

This quasi-experimental study used a crossover design[18] aimed at investigating the effect of MST on sleep disturbance in older adults in nursing homes. Two nursing homes were randomly assigned to either Group I or Group II through coin toss randomization. Group I received MST first and, after a two-week wash-out period, received routine care. Group II received routine care first and, after a two-week wash-out period, received MST (Figure 2).

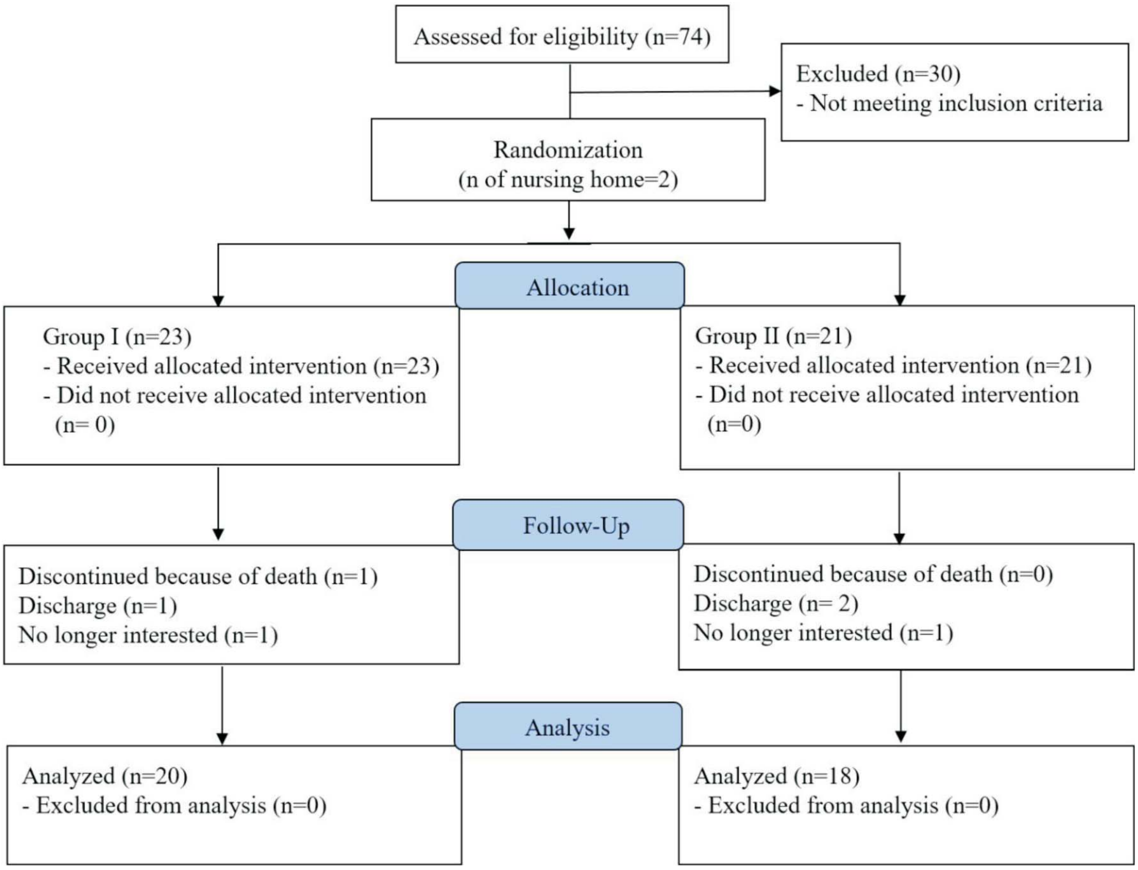

Figure 1. Flowchart of enrollment and follow-up of participants.

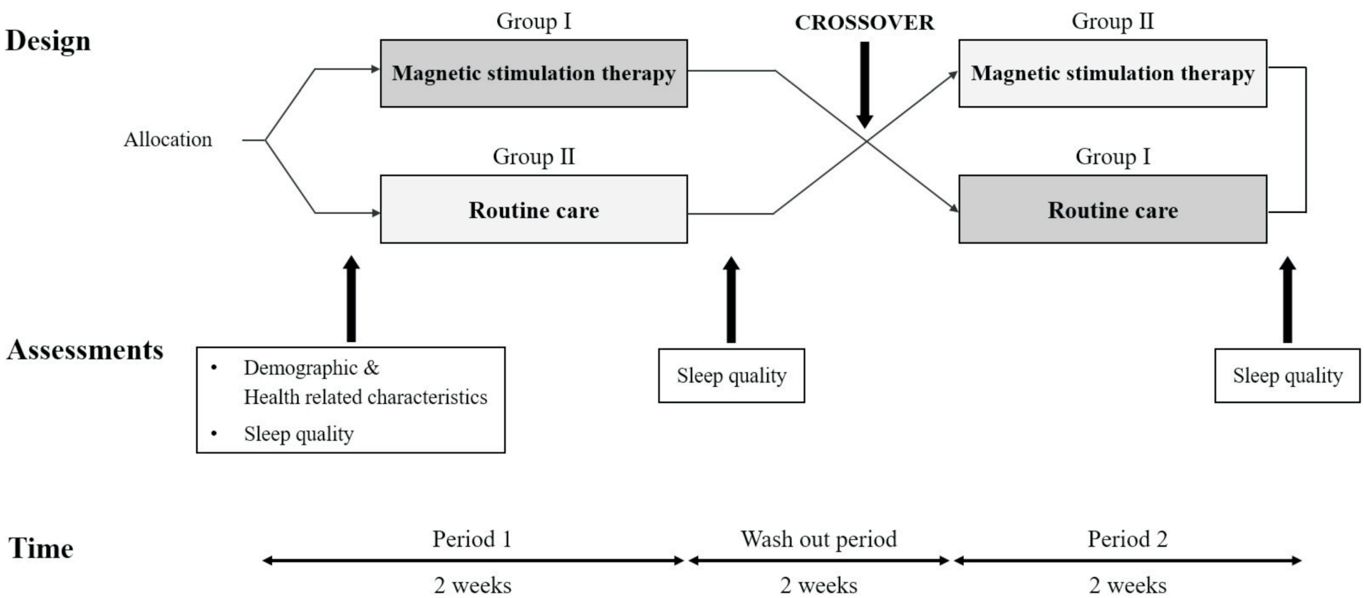

Figure 2. Research design.

For the intervention, 100 Gauss magnets[9] by consulting three domestic engineering material experts (J.L. Magnet, Seoul, Korea). Magnetic acupressure was applied to the Shenmen (HT7) points on the heart meridian, which are frequently used for their role in regulating hormones implicated in sleep disorders.[12] These points are located at both wrists, specifically at the wrist crease on the radial side of the flexor carpi-ulnaris tendon, and at both ears, situated upward of the antihelix in the triangular fossa (Figure 3).

To standardize the pressure intensity, the researchers and research assistants engaged in a 4-day training period for 30 min daily. They practiced acupressure within a range of 3–5 kg using a standard scale.[9,10] The researchers and research assistants confirmed whether the pressure intensity remained within a predetermined range for at least 9 of 10 repetitions ($\geq$ 90%). Throughout the research period, researchers and assistants conducted weekly consistency checks, and as needed, using the standard scale to maintain pressure intensity.

MST was performed for 5 seconds at a pressure of 3–5 kg per session, resting for 1 second, and pressing again 50 times. The intervention lasted for 5 minutes and was performed after meals, three times daily. MST was administered to patients from 8 AM to 8 PM for five weekdays followed by two rest days. Before conducting MST, participants were informed that they could stop the procedure at any time if they experienced pain or discomfort. The magnets were concealed using medical tape, and they adhered well to both ears and wrists. There were no instances of participants reporting pain or engaging in the act of swallowing the magnets.

Figure 3. Magnetic acupressure point to Shenmen (HT7) on both ear and wrist heart meridian.

2.3. Measurements

Objective sleep quality was measured by a wearable sleep device, Fitbit Inspire HR (Fitbit Inc., San Francisco, California, USA; Fitbit). According to a meta-analysis study on Fitbit for sleep duration, validity was 0.81–0.93 and sensitivity was 0.87–0.99. For sleep stages, sensitivity was reported as 0.95–0.96, with a specificity of 0.58–0.69:[14] 1) TST (minutes), sleep time between sleep onset and wake time; 2) wake time after sleep onset (WASO) (minutes), awake time between sleep onset and wake time; 3) WASO (%), percentage of WASO divided by the TST; 4) number of WASO; 5) total bed time (TBT) (minutes), minutes spent sleeping in bed; 6) sleep efficiency (SE) (%), percentage of TST divided by the TBT; 7) REM stage (minutes), time of rapid eye movement sleep as an intermediate step between awakening and shallow sleep; 8) NREM stages 1 and 2 (minutes), minutes of stage 1 and 2 of non-REM, shallow sleep; 9) NREM stage 3 (minutes), minutes of stage 3 of non-REM deep sleep; 10) REM (%), percentage of REM sleep times divided by TST; 11) NREM stages 1 and 2 (%), percentage of NREM stage 1 and 2 sleep times divided by TST; 12) NREM stage 3 (%), percentage of NREM stage 3 sleep times divided by TST. 13) sleep latency (SL) (minutes), time taken to transition from wakefulness to sleep. The Fitbit was applied to older adults for 12 hours daily (8 PM to 8 AM) for 3 days before and after MST and routine care. And we analyzed the average of the 3-day measured values.

Cognitive function was assessed using the Korean version of the Mini-Mental State Examination (MMSE-K).[19] The MMSE-K consists of 21 items. A score of 24 out of 30 was regarded as normal, 20–23 as mild cognitive impairment, and 19 as severe cognitive impairment. For MMSE,[20] the Cronbach's α was 0.89, and in this study, Cronbach's α for MMSE-K was 0.69.

Activities of daily living (ADL) were determined by utilizing the Korean Activities of Daily Living (K-ADL) instrument.[21] On the seven questions regarding dressing, washing, bathing, and assistance with using the toilet, one point was regarded as "independent," two points as "partially independent," and three points as "dependent." Higher scores indicate a greater need for help from caregivers. The reliability of the original instrument was Cronbach's α = .94,[22] and in this study was Cronbach's α =.93.

2.4. Statistical analysis

The collected data were analyzed using SAS version 9.4 (SAS Institute Inc. North Carolina, USA). Homogeneity between the two groups was compared using the independent samples t-test and chi-square test/Fisher's exact test. According to the Shapiro–Wilk test, objective sleep quality was normally distributed. The differences before and after MST and the differences between routine care were analyzed by paired t-test. The effects of the carry-over and period were analyzed using the independent samples t-test.

2.5. Ethical consideration

The study was approved by the Catholic University of Korea Institutional Review Board (IRB approval number: MC20TASE0006). The informed consent form for study participations and legal guardians was received in writing and anonymized. Before receiving the written consent form, the purpose, method, selection criteria, and expected effects of the study were fully explained to each individual.

3. Results

3.1. Sociodemographic characteristics

The sociodemographic characteristics of participants are shown in Table 1. The average age of the participants was 84.3 years; 76.3% were women and the average length of admission to nursing homes was 3.5 years. Group I and II had similar sociodemographic characteristics, except for gender and sedative use.

3.2. Comparison between two groups related to sleep variables.

Table 2 indicates objective sleep quality between the two groups before the first intervention. There was no significant difference between the sleep variables of the two groups ($p > 0.05$), except for REM (min), and REM (%).

3.3. Differences in the intervention, carry-over, and period effects

Table 3 presents the results of the analysis of the crossover design. The differences in intervention effects on TST, TBT, no.WASO, NREM 1, 2, NREM 1, 2 (%), REM, and REM (%) were significantly different ($p < 0.05$). In analyzing the carry-over effects of MST on participants' sleep based on the average value of Group I and Group II, demonstrated no significant difference in objective sleep quality, except for SL (p = .041). The period effect, according to the intervention order showed similar objective sleep quality across groups. However, differences were observed in SE (%), no.WASO, and WASO (%) in intervention order.

4. Discussion

This study evaluated objective sleep quality through a crossover design for older adults in nursing homes with sleep disorders to examine the effect of MST. The results showed significant differences between the MST intervention in TST, TBT, no.WASO, REM, REM (%) and NREM stages 1 and 2 sleep time. These findings suggest that MST may positively affect the objective sleep quality of nursing home residents with sleep disturbances.

MST was effective for improving REM sleep time and REM (%). This is consistent with the results of previous sleep architecture studies,[9,13] suggesting that MST effectively improves objective sleep quality. In this study, REM (%) ranged from 12.93% to 19.43% in Group I and from 15.31% to 19.36% in Group II, making the appropriate percentage of REM close to 20–25%. This result is different from that of a previous study that found no changes in REM sleep time and percentage of REM. In a previous study, MST was applied only to the ear's heart meridian (HT7),[9] but in this study, magnetic stimulation was extended to the wrist heart meridian (HT7). The Shenmen (HT7), located at the wrist joint on the radial side, is the most frequently used acupuncture point to regulate the imbalance, which is the core of sleep disorders.[12] A previous study reported that increased REM sleep has a positive effect on the cognitive function of older adults.[16] Sleep disturbance has received attention in geriatric

Table 1
Comparison of the two groups according to sociodemographic characteristics.

Variables	Total (n = 38)	Group I (n = 20)	Group II (n = 18)	χ^2/t	p
	Mean ± SD or N (%)	Mean ± SD or N (%)	Mean ± SD or N (%)		
Age (year)	84.32 ± 7.12	84.6 ± 4.41	84 ± 9.41	0.31	0.756
< 85	17 (44.74)	9 (45.00)	8 (44.44)		
≥ 85	21 (55.26)	11 (55.00)	10 (55.56)		
Gender[a]					0.007
Male	9 (23.68)	1 (5.00)	8 (44.44)		
Female	29 (76.32)	19 (95.00)	10 (55.56)		
Education[a]					0.293
Illiteracy	3 (7.89)	3 (15.00)	0 (0.00)		
Elementary school	7 (18.42)	5 (25.00)	2 (11.11)		
Middle school	12 (31.58)	6 (30.00)	6 (33.33)		
≥ High school	16 (42.11)	6 (30.00)	10 (55.56)		
Religion[a]					0.719
Yes	28 (73.68)	14 (70.00)	14 (77.78)		
No	10 (26.32)	6 (30.00)	4 (22.22)		
Spouse[a]					1.000
Yes	10 (26.32)	5 (25.00)	5 (27.78)		
No	28 (73.68)	15 (75.00)	13 (72.22)		
Children[a]					0.218
Yes	36 (94.74)	20 (100.00)	16 (88.89)		
No	2 (5.26)	0 (0.00)	2 (11.11)		
Duration of stay (year)	3.47 ± 2.66	4.15 ± 3.10	2.78 ± 2.22	1.47	0.151
Stroke[a,b]					0.709
Yes	9 (23.68)	4 (20.00)	5 (27.78)		
No	29 (76.32)	16 (80.00)	13 (72.22)		
Osteoporosis[a,b]					1.000
Yes	7 (18.42)	4 (20.00)	3 (16.67)		
No	31 (81.58)	16 (80.00)	15 (83.33)		
Parkinsonism[a,b]					1.000
Yes	1 (2.63)	1 (5.00)	0 (0.00)		
No	37 (97.37)	19 (95.00)	18 (100.00)		
Antihypertensives[b]				0.00	0.973
Yes	21 (55.26)	11 (55.00)	10 (55.56)		
No	17 (44.74)	9 (45.00)	8 (44.44)		
Sedatives[‡]				8.67	0.003
Yes	18 (47.37)	14 (70.00)	4 (22.22)		
No	20 (52.63)	6 (30.00)	14 (77.78)		
Antidiabetics[b]				1.64	0.200
Yes	11 (28.95)	4 (20.00)	7 (38.89)		
No	27 (71.05)	16 (80.00)	11 (61.11)		
MMSE-K	20.05 ± 5.15	20.30 ± 5.89	19.78 ± 4.35	0.31	0.760
ADL	13.47 ± 4.86	14.35 ± 5.11	12.50 ± 4.50	1.18	0.247

[a] Fisher's exact test. [b] Multiple responses of comorbidity and prescribed medications.
Abbreviations: ADL, activities of daily living; MMSE-K, Korean version of Mini Mental Status Examination.

Table 2
Comparison between two groups related to objective sleep variables.

Variables	Total (*n* = 38)	Group I (*n* = 20)	Group II (*n* = 18)	t	*p*
	Mean ± SD	Mean ± SD	Mean ± SD		
TST (min)	404.05 ± 123.02	379.40 ± 106.20	431.40 ± 137.20	-1.31	0.197
TBT (min)	467.79 ± 143.67	439.90 ± 125.80	498.80 ± 159.10	-1.27	0.212
SE (%)	86.55 ± 3.36	86.58 ± 3.61	86.52 ± 3.17	0.05	0.961
WASO (min)	63.74 ± 26.49	60.50 ± 25.42	67.33 ± 27.91	-0.79	0.435
WASO (%)	13.45 ± 3.36	13.42 ± 3.61	13.48 ± 3.17	-0.05	0.961
No. WASO	16.71 ± 7.25	14.85 ± 6.45	18.78 ± 7.70	-1.71	0.096
NREM 1, 2 (min)	293.87 ± 93.16	285.90 ± 84.21	302.80 ± 103.90	-0.55	0.583
NREM 1, 2 (%)	73.07 ± 9.11	75.32 ± 7.97	70.57 ± 9.84	1.64	0.109
NREM 3 (min)	44.29 ± 30.42	43.65 ± 25.34	45.00 ± 36.00	-0.13	0.894
NREM 3 (%)	10.91 ± 6.41	11.75 ± 5.72	9.98 ± 7.15	0.85	0.401
REM (min)	65.89 ± 36.35	49.90 ± 30.19	83.67 ± 34.95	-3.20	0.003
REM (%)	16.02 ± 7.40	12.93 ± 6.88	19.46 ± 6.53	-2.99	0.005
SL (min)	8.42 ± 11.01	12.50 ± 13.30	3.89 ± 4.98	2.69	0.013

Abbreviations: No. WASO, number of wakes after sleep onset; NREM 1, 2 (%), percent of non-rapid eye movement stage 1, 2; NREM 1, 2 (min), non rapid eye movement stage 1, 2; NREM 3 (%), percent of non-rapid eye movement stage 3; NREM 3 (min), non rapid eye movement stage 3; REM (%): percent of rapid eye movement; REM (min), rapid eye movement; SE (%), sleep efficiency; SL (min), sleep latency; TBT, total bed time; TST (min), total sleep time; WASO (%), percent of wake time after sleep onset; WASO (min), wake time after sleep onset.

Table 3
Effect of intervention, carry-over, period in Group I and II.

Variables	Intervention effect			Carry-over effect		Period effect	
	d[a] ± SE	t	*p*	t	*p*	t	*p*
TST (min)	132.66 ± 26.72	4.91	< .001	-0.11	.912	-0.28	.783
TBT (min)	142.97 ± 31.28	4.58	< .001	0.06	.955	-0.78	.440
SE (%)	1.63 ± 1.26	1.26	.217	-1.55	.131	2.55	.015
WASO (min)	10.32 ± 7.59	1.57	.125	0.73	.472	-2.41	.021
WASO (%)	-1.65 ± 1.27	-1.26	.216	1.55	.130	-2.57	.015
No. WASO	4.05 ± 1.46	2.87	.007	-1.15	.256	-1.31	.197
NREM 1, 2 (min)	68.24 ± 22.53	3.05	.004	-0.53	.597	-0.79	.437
NREM 1, 2 (%)	-7.65 ± 3.30	-2.27	.029	-0.62	.537	-1.23	.226
NREM 3 (min)	7.22 ± 7.95	0.87	.390	0.84	.408	0.52	.607
NREM 3 (%)	-1.72 ± 1.80	-1.02	.316	0.96	.345	1.13	.265
REM (min)	56.75 ± 10.97	5.09	< .001	0.44	.660	0.60	.551
REM (%)	9.18 ± 2.26	4.01	.000	0.12	.909	0.98	.333
SL (min)	-7.04 ± 3.76	-1.86	.072	-2.14	.041	-1.00	.326

[a] Mean difference in change between intervention.
Abbreviations: No. WASO, number of wakes after sleep onset; NREM 1, 2 (min), non rapid eye movement stage 1, 2; NREM 3 (min), non rapid eye movement stage 3; REM (min), rapid eye movement; SE (%), sleep efficiency; SL (min): sleep latency; TBT, total bed time; TST (min), total sleep time; WASO (%), percent of wake time after sleep onset; WASO (min), wake time after sleep onset.

research because there is growing evidence linking many health problems to sleep quality, including a decline in cognition in older adults.[15] Therefore, this MST approach is expected to improve the objective sleep quality in older adults with REM sleep disorder and will further contribute to the improvement of health outcomes.

After the MST intervention, only NREM stages 1 and 2 sleep time increased among NREM sleep structures. A previous study examining the stimulatory effect of auricular press pellet therapy in older adults with sleep disturbance also reported an elevation of NREM stage 2,[9] similar to the findings of this study. A systematic review of acupuncture's effect on sleep quality reported that most of the studies were conducted for three to four weeks.[23] In this study, the intervention period was about 2 weeks and the average age of the participants was 84 years, which was older than the previous study,[9] and the low cognitive function score was interpreted as insufficient to improve NREM stage 3 sleep time.

TST increased after MST, which is consistent with the results of a previous study that used actigraphy to identify sleep architecture after stimulating the Shenmen (HT7) in psychogeriatric inpatients.[24] In addition, in a study that analyzed sleep architecture after an acupressure intervention, TST was found to be the most affected parameter.[9,23] However, SE (%) did not increase significantly in this study. In the study, participants were old-old and 47.4% of them used sedatives. This effect seems to have affected the increase of TBT and negatively contributed to the improvement of SE (%). Nevertheless, participants with sleep disorders did not complain of sleep-related discomfort, and the sleep architecture was improved. This research indicates that, MST intervention will be an inexpensive, noninvasive and effective intervention for older adults in nursing homes suffering from sleep disturbances.

This study has some limitations. First, this study did not include variables such as urinary incontinence and circumstances such as time of light exposure, type of diet, obstructive sleep apnea, and roommate. Second, because this study had a small sample size and was predominantly female, any attempt to generalize results needs careful consideration. Third, efforts were made to evaluate sleep quality in an objective method, but the absence of blinding for the MST intervention may have increased the risk of bias.

5. Conclusion

In conclusion, this study found that MST was an effective intervention for TST, TBT, no.WASO, REM, REM (%) and NREM stages 1 and 2 sleep time among sleep architecture of nursing home residents with sleep disturbances. Based on the results of this study, the authors recommend conducting magnetic stimulation therapy as a routine intervention in nursing homes to evaluate long-term effects for older adults with sleep disturbance.

Conflict of interest

The authors declare that they have no conflicts of interest relevant to this study.

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References

1. Neikrug AB, Ancoli-Israel S. Sleep disturbances in nursing homes. *J Nutr Health Aging*. 2010;14(3):207–211. doi:10.1007/s12603-010-0051-8
2. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev.* 2002;6(2):97–111. doi:10.1053/smrv.2002.0186
3. Bah TM, Goodman J, Iliff JJ. Sleep as a therapeutic target in the aging brain. *Neurotherapeutics.* 2019;16(3):554–568. doi:10.1007/s13311-019-00769-6
4. Borges CR, Poyares D, Piovezan R, Nitrini R, Brucki S. Alzheimer's disease and sleep disturbances: a review. *Arq Neuropsiquiatr.* 2019;77(11):815–824. doi:10.1590/0004-282X20190149
5. McCleery J, Sharpley AL. Pharmacotherapies for sleep disturbances in dementia. *Cochrane Database Syst Rev*. 2020;11:CD009178. doi:10.1002/14651858.CD009178.pub4
6. Mehta P, Dhapte V, Kadam S, Dhapte V. Contemporary acupressure therapy: adroit cure for painless recovery of therapeutic ailments. *J Tradit Complement Med*. 2016;7(2):251–263. doi:10.1016/j.jtcme.2016.06.004
7. Becker RO, Selden G. *The body electric: electromagnetism and the foundation of life*. 1st ed. William Morrow; 1985.
8. Maldonado CC, Bentley AJ, Mitchell D. A pictorial sleepiness scale based on cartoon faces. *Sleep*. 2004;27(3):541–548. doi:10.1093/sleep/27.3.541
9. Lo C, Liao WC, Liaw JJ, Hang LW, Lin JG. The stimulation effect of auricular magnetic press pellets on older female adults with sleep disturbance undergoing polysomnographic evaluation. *Evid Based Complement Alternat Med*. 2013;2013:530438. doi:10.1155/2013/530438
10. Chen ML, Lin LC, Wu SC, Lin JG. The effectiveness of acupressure in improving the quality of sleep of institutionalized residents. *J Gerontol A Biol Sci Med Sci*. 1999;54(8):M389–M394. doi:10.1093/gerona/54.8.m389
11. Hmwe NTT, Browne G, Mollart L, Allanson V, Chan SW. Acupressure to improve sleep quality of older people in residential aged care: a randomised controlled trial protocol. *Trials*. 2020;21(1):360. doi:10.1186/s13063-020-04286-2
12. Simoncini M, Gatti A, Quirico PE, et al. Acupressure in insomnia and other sleep disorders in elderly institutionalized patients suffering from Alzheimer's disease. *Aging Clin Exp Res*. 2015;27(1):37–42. doi:10.1007/s40520-014-0244-9
13. Nordio M, Romanelli F. Efficacy of wrists overnight compression (HT 7 point) on insomniacs: possible role of melatonin?. *Minerva Med*. 2008;99(6):539–547.
14. Haghayegh S, Khoshnevis S, Smolensky MH, Diller KR, Castriotta RJ. Accuracy of wristband fitbit models in assessing sleep: systematic review and meta-analysis. *J Med Internet Res*. 2019;21(11):e16273. doi:10.2196/16273
15. Yuan J, Chen Y, Yu P, et al. Effect of magnetic stimulation of Shenmen point on cognitive function of chronic insomnia: a randomized controlled clinical trial. *Medicine (Baltimore)*. 2020;99(51):e23807. doi:10.1097/MD.0000000000023807
16. Altendahl M, Cotter DL, Staffaroni AM, et al. REM sleep is associated with white matter integrity in cognitively healthy, older adults. *PLoS One*. 2020;15(7):e0235395. doi:10.1371/journal.pone.0235395
17. Ferman TJ, Smith GE, Dickson DW, et al. Abnormal daytime sleepiness in dementia with Lewy bodies compared to Alzheimer's disease using the Multiple Sleep Latency Test. *Alzheimers Res Ther.* 2014;6(9):76. doi:10.1186/s13195-014-0076-z
18. Lin LC, Yang MH, Kao CC, Wu SC, Tang SH, Lin JG. Using acupressure and montessori-based activities to decrease agitation for residents with dementia: a cross-over trial. *J Am Geriatr Soc*. 2009;57(6):1022–1029. doi:10.1111/j.1532-5415.2009.02271.x
19. Kwon YC, Park JH. Korean Version of Mini-Mental State Examination (MMSE-K). Part I: Development of the Test for the Elderly. *J Korean Neuropsychiatr Assoc*. 1989;28(1):125–135.
20. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189–198. doi:10.1016/0022-3956(75)90026-6
21. Won CW, Rho YG, Kim SY, Cho BR, Lee YS. The validity and reliability of Korean activities of daily living (K-ADL) scale. *J Korean Geriatr Soc*. 2002;6(2):98–106.
22. Won CW, Yang KY, Rho YG, et al. The development of Korean activities of daily living (K-ADL) and Korean instrumental activities of daily living (K-IADL) scale. *J Korean Geriatr Soc*. 2002;6(2):107–120.
23. Waits A, Tang YR, Cheng HM, Tai CJ, Chien LY. Acupressure effect on sleep quality: A systematic review and meta-analysis. *Sleep Med Rev*. 2018;37:24–34. doi:10.1016/j.smrv.2016.12.004
24. Lu MJ, Lin ST, Chen KM, Tsang HY, Su SF. Acupressure improves sleep quality of psychogeriatric inpatients. *Nurs Res*. 2013;62(2):130–137. doi:10.1097/NNR.0b013e3182781524