

Table 3. Mean (SD) Changes in the Main Outcome Measure and Exercise Capacity

Exercise Capacity	Baseline	After 12 wk	Change From Baseline to Posttreatment Measurements	Mean Difference (95% CI)
Borg scale score				
PAG				-3.58 (-4.27 to -2.90)
≥75 (n = 14)	4.0 (2.4)	4.2 (2.7)	0.3 (1.3)	
<75 (n = 18)	4.4 (3.0)	4.9 (2.8)	0.5 (1.2)	
Total	4.2 (2.7)	4.6 (2.8)	0.4 (1.2)	
RAG				
≥75 (n = 12)	4.1 (2.2)	1.3 (0.9)	-2.8 (1.6)	
<75 (n = 18)	6.4 (2.9)	2.3 (1.8)	-4.2 (1.9)	
Total	5.5 (2.8)	1.9 (1.5)	-3.6 (1.9)	
6MWD, m				
PAG	405.2 (111.2)	385.8 (118.3)	-19.4 (48.7)	78.68 (54.16 to 103.21)
RAG	373.2 (115.2)	436.7 (101.0)	63.5 (49.9)	
SpO₂, % lowest rate				
PAG	88.3 (6.1)	86.7 (6.7)	-1.6 (2.2)	4.73 (3.49 to 5.96)
RAG	86.0 (7.0)	89.5 (5.2)	3.5 (2.9)	

Abbreviations: 6MWD, 6-minute walk distance; PAG, placebo acupuncture group; RAG, real acupuncture group; SpO₂, oxygen saturation as measured by pulse oximetry.

maximum inspiratory mouth pressure, maximum expiratory mouth pressure, and range of motion in the rib cage at the end of acupuncture treatment.

In this study, vital capacity, FVC, percentage of FEV₁, and percentage of DLCO significantly increased after acupuncture treatment. These findings suggest that acupuncture treatment might improve DOE and exercise endurance, at least to some extent, through the improvement of pulmonary function. It is not clear why acupuncture improves pulmonary function; however, we speculate that the relaxation of hyperactivated respiratory muscles and the correction of the autonomic tone might cause the beneficial effect on pulmonary function.²² Further investigations are needed to clarify this.

QUALITY OF LIFE AND ACUPUNCTURE

In the present study, the total score on the SGRQ was significantly decreased by -16.0 U in patients in the RAG. Jones²³ reported that the minimal clinically important difference for the total SGRQ score is 4 U or more; therefore, the effect of acupuncture on health-related quality of life was satisfactory in this study. Previous studies^{24,25} indicate that exercise capacity is an important determinant of quality of life in patients with COPD. The exercise capacity enhanced by acupuncture in the present study may have contributed to the improvement in the SGRQ. The GOLD guidelines emphasize that the overall approach to managing stable COPD should be individualized to address symptoms and improve quality of life.¹ Our results indicate that dyspnea and quality of life of patients in the RAG were markedly improved, suggesting that acupuncture is a useful modality to manage stable COPD.

NUTRITIONAL DISORDER AND ACUPUNCTURE

Malnutrition is one of the major problems in patients with COPD.^{1,26,27} A nutritional disorder leads to loss of body weight and muscle volume,²⁶ resulting in decreased

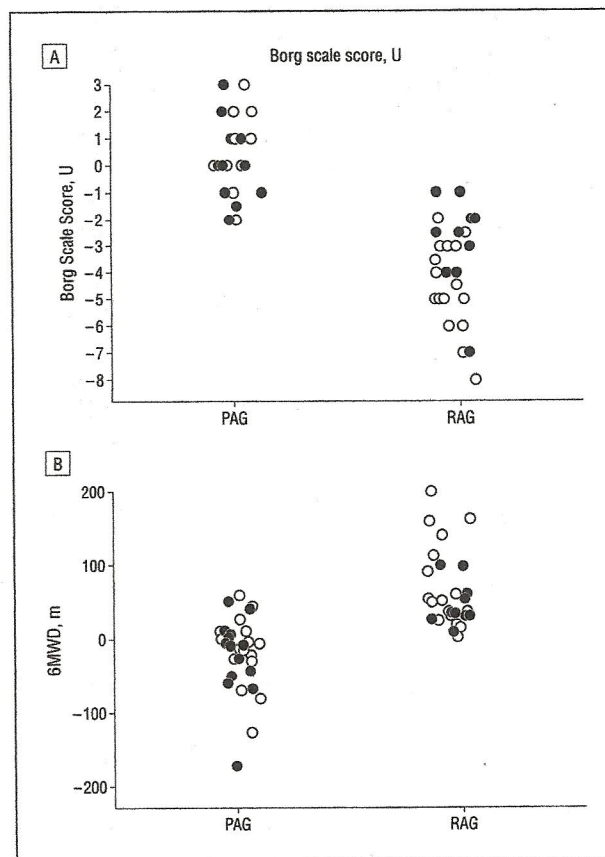


Figure 3. Differences in the Borg scale score and 6-minute walk distance (6MWD) test in the placebo acupuncture group (PAG) and the real acupuncture group (RAG). Differences in the Borg scale score (A) and 6MWD (B) between baseline and at the end of the intervention. Open circles indicate patients younger than 75 years; closed circles, patients 75 years or older. Estimated mean differences (95% CIs) (error bars) were -3.58 (-4.27 to -2.90) and 78.68 (54.16 to 103.21) for the Borg scale score and 6MWD, respectively.

strength of the respiratory muscles and intolerance to exercise.²⁸ Our study clearly demonstrated that reduced

Table 4. Mean (SD) Changes in St George Respiratory Questionnaire Scores

Scale	Baseline	After 12 wk	Change From Baseline to Posttreatment Measurements	Mean Difference (95% CI)
Total				-15.7 (-20.3 to -11.2)
PAG	40.8 (15.4)	41.1 (16.0)	0.3 (7.9)	
RAG	46.2 (14.2)	30.2 (15.7)	-16.0 (9.7)	
Symptom				-24.7 (-32.2 to -17.1)
PAG	53.2 (20.6)	50.5 (14.4)	-2.6 (14.4)	
RAG	54.7 (18.9)	26.9 (17.7)	-27.8 (17.3)	
Activity				-16.2 (-22.8 to -9.61)
SAG	53.1 (19.0)	55.9 (19.6)	2.8 (13.1)	
RAG	58.6 (16.9)	44.6 (22.0)	-14.0 (13.6)	
Impact				-12.1 (-16.7 to -7.59)
PAG	26.7 (15.5)	26.8 (16.1)	0.1 (8.2)	
RAG	33.5 (15.2)	20.5 (15.1)	-13.0 (9.6)	

Abbreviations: PAG, placebo acupuncture group; RAG, real acupuncture group.

Table 5. Mean (SD) Changes in the Other Outcome Measures

Outcome Measure	Baseline	After 12 wk	Change From Baseline to Posttreatment Measurements	Mean Difference (95% CI)
Medical Research Council				-0.78 (-1.11 to -0.44)
PAG	2.9 (1.1)	2.8 (1.2)	-0.1 (0.5)	
RAG	3.2 (0.9)	2.3 (1.1)	-0.9 (0.8)	
BMI				1.16 (0.77 to 1.55)
PAG	21.3 (3.9)	21.1 (3.6)	-0.2 (0.5)	
RAG	21.7 (3.9)	22.7 (4.0)	1.0 (1.0)	
Prealbumin level, g/dL				2.84 (0.93 to 4.76)
PAG	23.4 (3.7)	22.9 (4.6)	-0.5 (2.6)	
RAG	23.0 (4.9)	25.4 (6.7)	2.4 (4.7)	
pH				0.001 (-0.01 to 0.01)
PAG	7.41 (0.02)	7.41 (0.02)	0.003 (0.02)	
RAG	7.42 (0.02)	7.42 (0.03)	0.004 (0.03)	
Paco ₂				-0.40 (-2.12 to 1.31)
PAG				
mm Hg	41.8 (4.5)	41.5 (4.9)	-0.32 (3.3)	
kPa	5.56 (0.6)	5.53 (0.7)		
RAG				
mm Hg	40.2 (3.7)	39.5 (4.8)	-0.72 (3.4)	
kPa	5.36 (0.5)	5.26 (0.5)		
Pao ₂				11.18 (4.70 to 17.66)
PAG				
mm Hg	78.3 (11.8)	74.5 (12.3)	-3.84 (13.3)	
kPa	10.5 (1.6)	9.90 (1.7)		
RAG				
mm Hg	70.9 (11.7)	78.2 (12.7)	7.34 (12.1)	
kPa	9.5 (0.6)	10.42(1.7)		
Bicarbonate, mEq/L				-0.37 (-1.11 to 0.36)
PAG	25.8 (2.1)	25.7 (2.2)	-0.10 (1.5)	
RAG	25.5 (1.9)	25.1 (2.2)	-0.47 (1.4)	
Rib cage ROM, cm				3.20 (2.28 to 4.12)
PAG	3.7 (1.6)	3.6 (1.8)	-0.1 (1.5)	
RAG	2.3 (1.5)	5.4 (2.6)	3.1 (2.1)	

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); PAG, placebo acupuncture group; RAG, real acupuncture group; ROM, range of motion.

SI conversion factors: To convert albumin to grams per liter, multiply by 10; and to convert bicarbonate to millimoles per liter, multiply by 1.0.

BMI and prealbumin level in COPD patients were recovered after 12 weeks of acupuncture. It was reported that acupuncture at ST36 (*Zusanli*) and CV12 (*Zhongwan*) ac-

celerates gastric emptying,²⁹ which may consequently facilitate food ingestion. We therefore suggest that improvement in gastrointestinal function and reduced

Table 6. Mean (SD) Changes in the Respiratory Functions and the Respiratory Muscle Strength

Respiratory Variable	Baseline	After 12 wk	Change From Baseline to Posttreatment Measurements	Mean Difference (95% CI)
VC, L				0.09 (-0.07 to 0.25)
PAG	3.1 (0.7)	3.1 (0.7)	-0.03 (0.3)	
RAG	2.9 (0.5)	2.9 (0.6)	0.06 (0.4)	
IC, L				0.10 (-0.05 to 0.25)
PAG	1.9 (0.5)	1.9 (0.5)	-0.01 (0.2)	
RAG	1.8 (0.4)	1.9 (0.5)	0.09 (0.4)	
FVC, L				0.24 (0.14 to 0.35)
PAG	3.0 (0.7)	2.9 (0.6)	-0.10 (0.2)	
RAG	2.8 (0.5)	2.9 (0.5)	0.14 (0.2)	
FEV ₁ , L				0.09 (-0.02 to 0.20)
PAG	1.1 (0.3)	1.1 (0.3)	-0.04 (0.2)	
RAG	1.0 (0.3)	1.1 (0.3)	0.07 (0.3)	
FEV ₁ , % predicted				4.20 (0.04 to 8.37)
PAG	47.9 (16.5)	46.9 (17.7)	-1.00 (4.8)	
RAG	46.0 (16.6)	49.2 (19.5)	3.17 (10.7)	
FRC, L				-0.02 (-0.28 to 0.24)
PAG	4.1 (0.9)	4.1 (0.8)	-0.02 (0.5)	
RAG	3.7 (0.8)	3.6 (0.8)	-0.04 (0.5)	
TLC, L				0.01 (-0.31 to 0.33)
PAG	6.0 (1.1)	6.0 (1.0)	-0.02 (0.6)	
RAG	5.5 (0.9)	5.5 (0.9)	-0.01 (0.7)	
RV/TLC, %				-0.89 (-4.12 to 2.31)
PAG	47.5 (8.8)	47.2 (8.8)	-0.21 (4.8)	
RAG	46.7 (6.1)	45.6 (7.2)	-1.10 (7.6)	
Dlco, mL/min/mm Hg				1.20 (0.14 to 2.26)
PAG	10.1 (4.3)	9.6 (5.1)	-0.52 (2.1)	
RAG	9.8 (5.5)	10.4 (5.5)	0.68 (2.1)	
Dlco/VA, mL/min/mm Hg/L				0.24 (-0.01 to 0.48)
PAG	2.3 (1.2)	2.2 (1.2)	-0.12 (0.3)	
RAG	2.3 (1.5)	2.4 (1.4)	0.12 (0.6)	
MEP, H ₂ O cm				36.09 (26.41 to 45.77)
PAG	63.5 (21.5)	61.8 (22.9)	-1.70 (12.2)	
RAG	59.5 (21.6)	93.9 (32.2)	34.4 (24.3)	
MIP, H ₂ O cm				14.83 (8.49 to 21.16)
PAG	56.4 (20.6)	55.4 (19.5)	-1.0 (11.9)	
RAG	60.8 (20.6)	74.6 (15.8)	13.8 (13.0)	

Abbreviations: DLco, carbon monoxide diffusing capacity; FEV₁, forced expiratory volume in 1 second; FRC, functional residual capacity; FVC, forced vital capacity; IC, inspiratory capacity; L, liter; MEP, maximum expiratory mouth pressure; MIP, maximum inspiratory mouth pressure; PAG, placebo acupuncture group; RAG, real acupuncture group; RV, residual volume; TLC, total lung capacity; VA, alveolar volume; VC, vital capacity.

dyspnea during mealtime may facilitate food intake, resulting in a better nutritional condition of the patient. In addition, reduction in energy expenditure in the respiratory muscles, which was derived from relaxation of the muscles, reduction in oxygen consumption, and improvement in DOE, may contribute to the improvement in nutritional status.

STUDY LIMITATIONS

Our study has some limitations. First, most patients were already taking standard medication for COPD because it was practically impossible to recruit those who are not receiving medication. Although the baseline medications were not significantly different between the RAG and PAG, changes in outcome measures in the present trial may have been achieved not only by acupuncture but also by additional or synergic effects of medication. Second, this study was performed in a relatively short period without follow-up evaluation. Acupuncture was

shown to improve BMI, MRC criteria, and 6MWD, but another study should be performed to confirm the long-term effect of acupuncture on COPD. Finally, this study was performed as a placebo-controlled, randomized trial using placebo acupuncture. Although no significant difference was found in the proportion of patients regarding perception of real and placebo needling, we were unable to mask the acupuncture therapists, which might influence the results based on their attitudes.

CONCLUSIONS

We demonstrated clinically relevant improvements in DOE (Borg scale), nutrition status (including BMI), airflow obstruction, exercise capacity, and health-related quality of life after 3 months of acupuncture treatment. Randomized trials with larger sample sizes and longer-term interventions with follow-up evaluations are necessary to confirm the usefulness of acupuncture in COPD treatment.

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