**SUPPLEMENTARY INFORMATION**

**Sternocleidomastoid muscle thickness correlates with exercise tolerance in COPD patients**

**Authors’ full names:**

Masashi Shiraishi,1,2 Yuji Higashimoto,1 Ryuji Sugiya,1 Hiroki Mizusawa,1 Yu Takeda,1 Shuhei Hujita,1 Osamu Nishiyama,2 Shintarou Kudo,3 Tamotsu Kimura,1 Yasutaka Chiba,4 Kanji Fukuda,1 Yuji Tohda2

**Authors’ affiliation(s):**

1Department of Rehabilitation Medicine, Kindai University School of Medicine, Osaka, Japan

2Department of Respiratory Medicine and Allergology, Kindai University School of Medicine, Osaka, Japan

3Graduate School of Health Sciences, Morinomiya University of Health Sciences, Osaka, Japan

4Division of Biostatistics, Clinical Research Center, Kindai University School of Medicine, Osaka, Japan

Table 1S: Multiple regression analysis performed with the peak VO2 as the dependent variable

Table 2S: SCM thickness and intra-class correlation coefficient

Figure 1S: Correlation between maximum sternocleidomastoid muscle thickness at end-expiration and IC in patients with chronic obstructive pulmonary disease (n = 44)

Figure 2S: Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and the predicted FEV1% in patients with chronic obstructive pulmonary disease (n = 44).

Figure 3S: Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and the MIP in patients with chronic obstructive pulmonary disease (n = 44).

Figure 4S: Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and BMI in patients with chronic obstructive pulmonary disease (n = 44).

Figure 5S: Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and SCM TF from end-expiration to resting inspiration in patients with chronic obstructive pulmonary disease (n = 44).

**Table 1S.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Model 1 | β | B | SE | 95% CI | R2 | t | p |
| End-expiration　to　end-inspiration  SCM thickness fraction, % | 0.712 | 0.083 | 0.015 | 0.054 to 0.113 | 0.470 | 5.719 | <0.001 |
|  |  |  |  |  |  |  |  |
| Model 2 | β | B | SE | 95% CI | R2 | t | p |
| End-expiration　to　end-inspiration  SCM thickness fraction, % | 0.627 | 0.054 | 0.017 | 0.019 to 0.089 | 0.572 | 3.105 | 0.003 |
| FEV1, % | 0.377 | 0.065 | 0.024 | 0.017 to 0.112 |  | 2.745 | 0.009 |
|  |  |  |  |  |  |  |  |
| Model 3 | β | B | SE | 95% CI | R2 | t | p |
| End-expiration　to　end-inspiration  SCM thickness fraction, % | 0.542 | 0.049 | 0.016 | 0.016 to 0.082 | 0.670 | 3.008 | 0.005 |
| FEV1, % predicted | 0.257 | 0.044 | 0.023 | -0.003 to 0.091 |  | 1.885 | 0.067 |
| IC, L | 0.303 | 2.135 | 0.811 | 0.012 to 0.495 |  | 2.631 | 0.012 |

Abbreviations: SCM = sternocleidomastoid muscle, FEV1 = forced expiratory volume in one second, IC = inspiratory capacity

**Table 2S.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Intraclass Correlation | 95% Confidence Interval | | F Test With True Value 0 | | | |
|  | Lower Bound | Upper Boound | Vaiue | *df* 1 | *df* 2 | Sig |
| End-expiration | 0.94 | 0.463 | 0.986 | 128.056 | 19 | 38 | .000 |
| Resting inspiration | 0.88 | 0.654 | 0.956 | 14.001 | 20 | 40 | .000 |
| End-inspiration | 0.92 | 0.374 | 0.981 | 90.213 | 19 | 38 | .000 |

Figure 1S. Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and the IC in patients with chronic obstructive pulmonary disease (n = 44). IC = Inspiratory Capacity. The IC had a significantly positive correlation with the sternocleidomastoid muscle thickness in patients with chronic obstructive pulmonary disease (r = 0.51, p < 0.01).

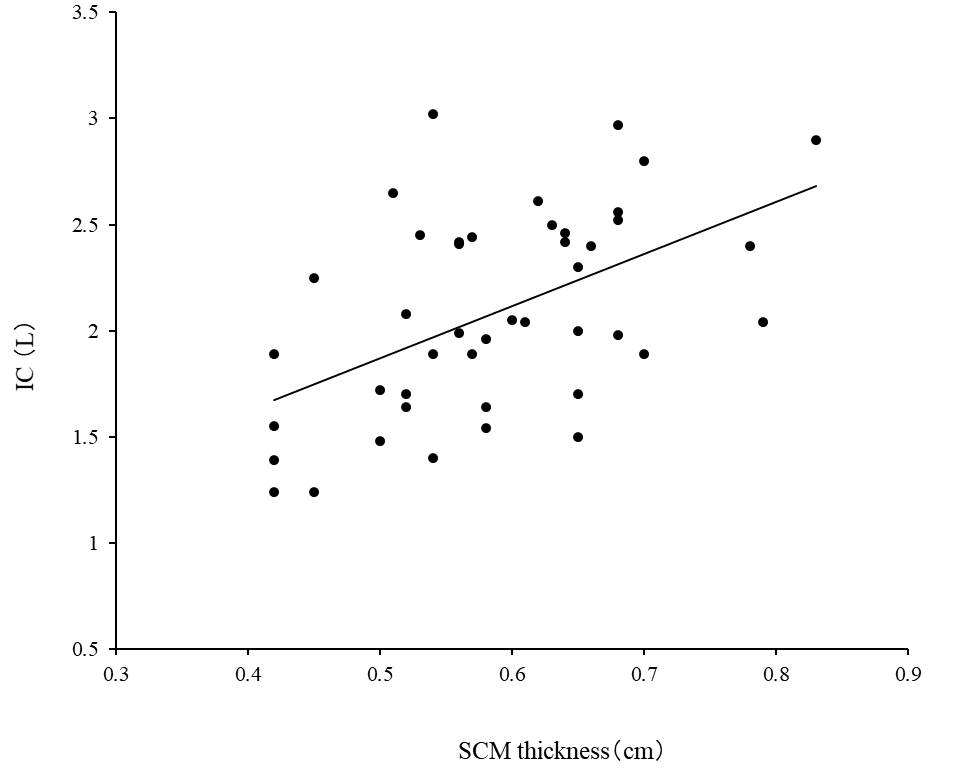


Figure 2S. Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and the predicted FEV1% in patients with chronic obstructive pulmonary disease (n = 44). FEV1% = percent predicted Forced Expiratory Volume in one second. The predicted FEV1% had a significantly positive correlation with the sternocleidomastoid muscle thickness in patients with chronic obstructive pulmonary disease (r = 0.46, p < 0.05).

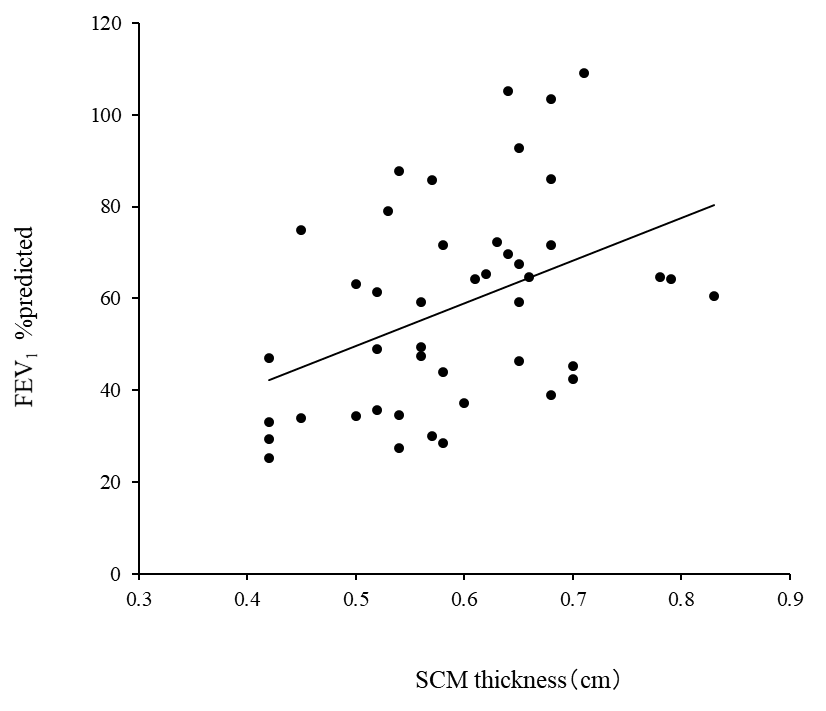


Figure 3S. Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and MIP in patients with chronic obstructive pulmonary disease (n = 44). MIP = maximum inspiratory pressure. The MIP had a significantly positive correlation with the sternocleidomastoid muscle thickness in patients with chronic obstructive pulmonary disease (r = 0.49, p < 0.05).

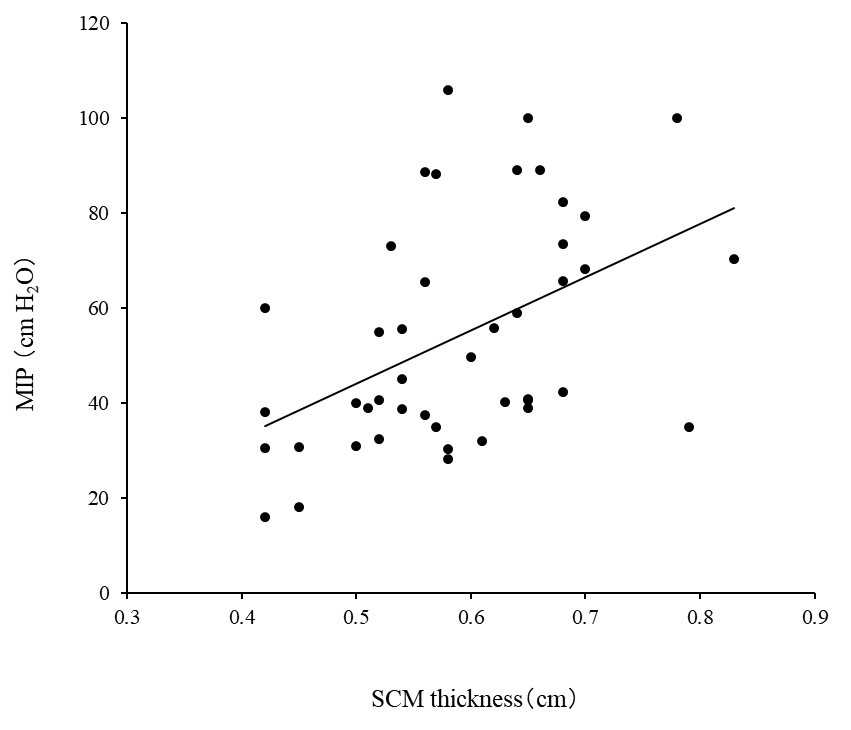


Figure 4S. Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and BMI in patients with chronic obstructive pulmonary disease (n = 44). BMI = Body Mass Index. BMI had a significantly positive correlation with the sternocleidomastoid muscle thickness in patients with chronic obstructive pulmonary disease (r = 0.39, p < 0.05).

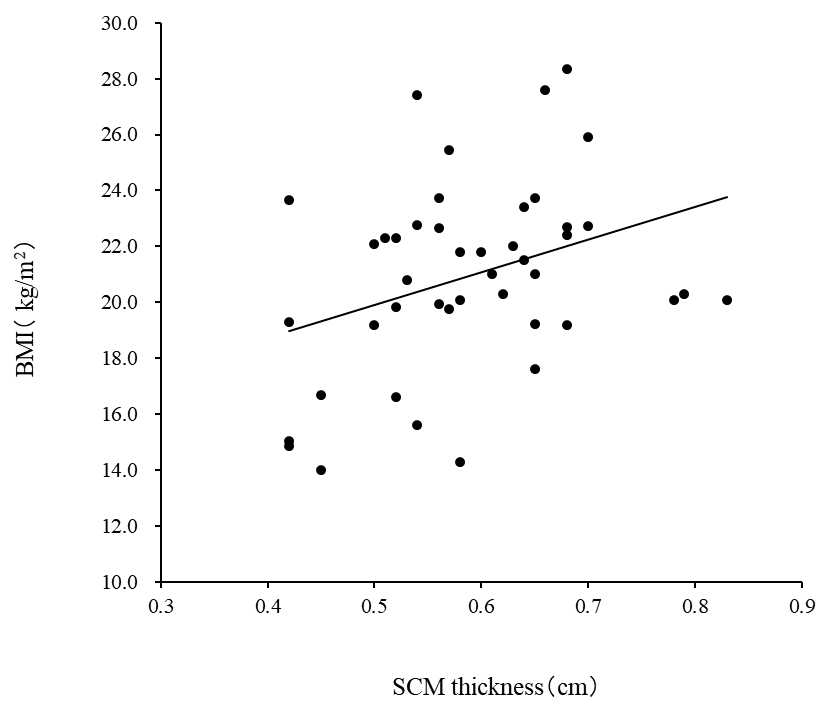


Figure 5S. Correlation between the maximum sternocleidomastoid muscle thickness at end-expiration and sternocleidomastoid muscle thickening fraction in patients with chronic obstructive pulmonary disease (n = 44). Sternocleidomastoid muscle thickening fraction had a significantly negativity correlation with the sternocleidomastoid muscle thickness in patients with chronic obstructive pulmonary disease (r = -0.62, p < 0.01).

