Effects of face masks on oxygen saturation and functional measures in patients with connective tissue disorder-associated interstitial lung disease

Face masks are a first-line defence against the COVID-19 pandemic. Concerns about face masks reducing oxygen saturation (SpO2) have been negated by controlled studies in healthy individuals. Universal masking must be followed without exceptions. However, persons with pre-existing cardiorespiratory diseases like interstitial lung diseases (ILD) have limited functional reserves. We explored the effects of face masks in patients with connective tissue disease (CTD)-associated ILD (CTD-ILD).

Patients between 18 and 75 years of age with high-resolution CT (HRCT)-proven CTD-ILD and with Medical Research Council scale grades 1–3 dyspnoea and forced vital capacity (FVC) of less than 70% were included in this crossover trial. If FVC was >70%, patients were included only if the extent of involvement on HRCT was more than 20% of the lung. Patients requiring oxygen supplementation and with myositis or lower limb pain were excluded. Initial SpO2 was recorded and a standard 6 min walk test (6MWT) was carried out with and then without a standard three-layer surgical face mask. Adequate precautions were taken to prevent the spread of COVID-19 during the tests. Distance covered during the 6MWT was the primary outcome measure. The secondary outcome measures were drop in SpO2, time for saturation to return to baseline and dyspnoea measured on the Borg Dyspnoea Scale. Considering a mean (SD) 6MWT distance of 250 (53) m and a minimal clinically significant difference of 10% reduction, with alpha of 0.05 and power of 80%, the sample size was calculated at 36. The trial was registered as CTRI/2021/01/050234 in the Clinical Trial Registry of India (CTRI). Paired Student’s t-test, Wilcoxon signed-rank test and McNemar test were performed using SPSS V23.0.

After block randomisation, 18 patients were assessed without masks on first and 18 with masks on first. All 36 patients (online supplemental table 1) completed 6MWT both with and without masks. The participants covered a mean of 12.9 m (95% CI 4.5 to 21.4; p=0.004) lesser distance and had a larger drop in saturation (p=0.03) while on masks than when not wearing masks. The number of persons who had any rise in the Borg Dyspnoea Scale during peak activity was significantly different (table 1). A decline in SpO2 of 2% or more occurred in 14 participants without masks and in 19 with masks (p=0.3; Fisher’s exact test).

Thus, the use of face masks reduced functional capacity and SpO2 during activity in patients with CTD-ILD. Even with the

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Parameters during 6MWT in 36 patients with connective tissue disorder-associated interstitial lung diseases with and without face masks</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Without face masks</td>
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<tr>
<td>Distance covered (m)</td>
<td>264.3 (44.1)</td>
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<tr>
<td>Baseline oxygen saturation (%)</td>
<td>97.4 (2.4)</td>
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<tr>
<td>Oxygen saturation (%) at completion of 6MWT</td>
<td>94.4 (5.7)</td>
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<tr>
<td>Drop in oxygen saturation (%)</td>
<td>3.0 (3.8)</td>
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<tr>
<td>Time taken for recovery of oxygen saturation (s)</td>
<td>35.4 (65.2)</td>
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<tr>
<td>Number who had rise in Borg Dyspnoea Scale by at least single unit</td>
<td>21</td>
</tr>
</tbody>
</table>

Data presented as mean (SD).
*Student’s t-test for parametric data (distance covered), Wilcoxon signed-rank test for non-parametric data (rest) and McNemar test for proportions. 6MWT, 6 min walk test.
roll-out of COVID-19 vaccines around the world, masks remain the standard of care. We strongly advocate the use of masks for all, including patients with ILD, who may be at higher risk if they develop COVID-19. Although only CTD or IDL may not confer additional risk for COVID-19, the presence of ILD increases the risk of severe disease.4

Functional MRI studies have shown carbon dioxide retention while wearing face mask alters brain oxygenation patterns without affecting task activation in healthy subjects.7 Other studies which have shown no effect of masks have been on elderly participants without any active exertion2 or on young adults during exercise.1 However, these studies had smaller numbers and did not evaluate patients with lung disease during exertion. Conversely, it should also be kept in mind that dyspnoea is a subjective feeling and patients with respiratory diseases may be subconsciously biased against masks.5 This study should not be misinterpreted as implying face masks should not be used in patients with CTD-ILD.

Our limitations include the use of surgical mask only. However, this was to standardise the experiment. We expect other types of masks and idiopathic ILD to behave similarly.

We reiterate that it is quintessential for these patients to continue wearing masks. However, patients with ILD, their caregivers and physicians should know that functional capacity may be reduced with masks. Patients should limit physical exertion while wearing masks.

This study should not be misinterpreted as implying face masks should not be used by patients with CTD-ILD because this would risk COVID-19 infection, which would be very much detrimental to such patients. Continuous use of masks as well as other COVID-19 protocols is secondary to none.

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Handling editor Josef S Smolen

Contributors Conceptualisation: PS. Methodology: PS, SaA, SuA, AV, SJ. Writing—original draft: SaA. Writing—review and editing: all authors. All authors have approved the final manuscript and take full responsibility for the integrity of the data and the content of the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval The trial was approved by the Sree Sudheendra Medical Mission Hospital Ethics Committee.

Provenance and peer review Not commissioned; externally peer reviewed.

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Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/annrheumdis-2021-220230).


Received 23 February 2021
Revised 29 April 2021
Accepted 29 April 2021
Published Online First 10 May 2021


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