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Recovery of Pulmonary Function Following Endoscopic Anterior Scoliosis Correction:
Evaluation at 3, 6, 12 and 24 months post-surgery

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Respiratory Scientist, and Dr David M. Cooper, Director, from the Department of Respiratory and
Sleep Medicine, Mater Children’s Hospital, Brisbane, Australia.
Mini Abstract

Pulmonary function tests were performed preoperatively and at 3, 6, 12, and 24 months postoperatively for a series of 44 endoscopic anterior scoliosis surgery patients. FVC and FEV₁ both decrease initially, followed by recovery to 5-8% above preoperative values at 24 months. The endoscopic procedure therefore has no lasting negative effect on pulmonary function and with prolonged follow up, pulmonary capacity improves beyond pre-operative levels.
Key Points

- A study of the recovery of pulmonary function following endoscopic anterior scoliosis instrumentation was undertaken with 44 patients at the Mater Children’s Hospital, Brisbane, Australia.

- The pulmonary function results from this series are comparable and complimentary to recently published results from a US series of thoracoscopic scoliosis cases.

- Statistically significant improvements in most PFT values occurred between 3-6 months and 6-12 months post-surgery. Improvements in absolute and % reference FVC, FEV₁ and TLC continue between 12 and 24 months although only the increase in absolute FVC during this time period is statistically significant.

- Following a decline of approximately 10% at 3 months post-surgery, FVC and FEV₁ both recover to exceed preoperative levels by 5-8% between 12 and 24 months post-surgery, while TLC returns to preoperative levels.

- Endoscopic anterior scoliosis surgery has no lasting negative effect on pulmonary function and with prolonged follow up, patients tend to develop improved pulmonary function which may be due to the endoscopic approach or to the scoliosis correction itself.
Abstract

Study Design: A series of scoliosis patients undergoing endoscopic anterior instrumentation and fusion undertaking repeated pulmonary function assessments. Objectives: To assess recovery of pulmonary function in the two years following endoscopic anterior scoliosis correction. Summary of Background Data: Recent studies have found that pulmonary function returns to preoperative levels 12-24 months following endoscopic anterior scoliosis correction, and a small improvement in forced expiratory volume has also been reported. Methods: A series of 44 endoscopic anterior scoliosis correction cases underwent pulmonary function tests preoperatively, and at 3, 6, 12 and 24 months postoperatively. Forced vital capacity, forced expiratory volume, and total lung capacity were measured. Non-parametric statistical analysis was used to investigate changes in pulmonary function between successive assessments. Results: Pulmonary function decreased by approximately 10% at 3 months post-surgery. At 24 months post-surgery, forced vital capacity (FVC) and forced expiratory volume (FEV1) recover to 5-8% above preoperative levels, while total lung capacity (TLC) returns to preoperative levels. Statistically significant improvements in most pulmonary function values occur between 3-6 months and 6-12 months. Improvements in mean FVC, FEV1 and TLC continue between 12 and 24 months although only the increase in absolute FVC for this time period is statistically significant. Conclusions: Endoscopic anterior scoliosis surgery has no lasting negative effect on pulmonary function and with prolonged follow up, pulmonary capacity improves beyond pre-operative levels.

Keywords

Pulmonary function, endoscopic anterior scoliosis correction, forced vital capacity, forced expiratory volume, total lung capacity
Introduction

Recovery of pulmonary function following surgery is an important aspect of the treatment of young patients using minimally invasive anterior approaches for scoliosis correction. Reduced tissue dissection is expected to cause less reduction in pulmonary function following endoscopic surgery compared with open approaches. This has been confirmed by Newton et al. and Faro et al., who found the endoscopic approach resulted in less Forced Vital Capacity (FVC) impairment compared with open anterior scoliosis surgery at both 3 and 12 months post-operatively.

When compared to preoperative values, the endoscopic approach appears to allow full recovery in pulmonary function which has not been achieved with open anterior approaches: Graham et al. found that percent reference values remained at 95% of preoperative levels two years after open thoracotomy for anterior instrumented spinal fusion in adolescent idiopathic scoliosis, whereas Faro et al. found that FVC recovered completely by 12 months after endoscopic scoliosis surgery. Although Forced Expiratory Volume (FEV$_1$) in Faro’s study remained lower than pre-operative values 12 months after surgery, Newton et al. (2005) have recently published two year postoperative data showing a small but statistically significant increase in FEV$_1$ compared with preoperative levels for anterior endoscopic scoliosis surgery.

Improvements in pulmonary function above preoperative levels have been reported by a number of authors following posterior scoliosis surgery, and it is important to further establish whether the same benefit occurs following endoscopic anterior approaches. It is also important to compare changes in pulmonary function between successive follow-up assessments to provide clinicians and patients with accurate expectations for pulmonary function recovery. The few previous
studies of pulmonary function following anterior endoscopic scoliosis correction have compared postoperative and preoperative pulmonary function, but have not statistically investigated changes between successive postoperative assessments which are needed to quantify trends in recovery following endoscopic scoliosis surgery.

Materials and Methods

Study Cohort. Ninety-one patients have undergone anterior endoscopic correction for scoliosis at the Mater Children’s Hospital, Brisbane with a single surgeon between 2000 and 2005. In 2002, a case series study was established to assess pulmonary function changes following surgery. Patients with anxiety disorders or intellectual impairment were excluded from the study due to their inability to perform technically satisfactory pulmonary function tests. Subjects were also excluded if they were geographically isolated and therefore unable to attend follow-up pulmonary function assessments at the same clinic location where their preoperative tests occurred. A total of 44 patients were enrolled in the study.

Surgical Technique. The choice to perform anterior scoliosis instrumentation and fusion via endoscopic approach was made after assessment of each patient by the senior author on clinical grounds. Surgery was performed in a side lying position with access via three or four portals in the chest wall. Portal positions were selected using an image intensifier positioned in two planes. Each portal incision was 2 centimeters in length. Double lumen tube intubation was used to achieve single lung ventilation for the duration of the procedure. Discectomy was performed at the levels to be instrumented, and intervertebral spaces were packed with femoral head allograft for 41 of the patients. The remaining 3 patients underwent thoracoplasty and mulched rib head autograft was used to pack the intervertebral spaces. A single 4.5mm diameter anterior rod and
vertebral body screws (Eclipse, Medtronic Sofamor Danek, Memphis, USA) were used to
achieve curve correction using a standard compression technique with x-ray monitoring. After
visualization of lung re-inflation, a chest drain was inserted prior to closure of the final operative
portal. The chest drain was removed on average 2.20 days (range 1-6) postoperatively and
patients were mobilized on average 1.50 days (range 1- 4) postoperatively. Patients were braced
for 6-12 weeks following surgery.

Physical Therapy
Physical therapy was performed only during the hospital stay of each patient and consisted of
breathing exercises and incentive spirometry (Paediatric Voldyne, Mayo Healthcare Pty Ltd,
Australia). Patients were advised to perform a graduated walking programme after discharge
from hospital. No other physical therapy or breathing exercises were prescribed.

Spinal Curve Measurement
Spinal curve parameters measured for each patient included coronal plane Cobb angle, rib hump,
sagittal plane T5-T12 kyphosis, and Lenke curve classification. Rib hump measurements were
made using a Scoliometer (Scoliosis Research Society, Milwaukee, WI), and all other curve
parameters were measured from full length clinical radiographs. For post-operative assessments,
the instrumented Cobb angle was defined as the Cobb angle of the region of the curve spanned by
the anterior rod. Curve corrections were expressed as a percentage of the pre-operative Cobb
angle.

Pulmonary Function Testing. Patients underwent pulmonary function tests (PFTs) pre-
operatively, and at 3, 6, 12 and 24 months after surgery. FVC, FEV$_1$, and TLC were measured
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according to published guidelines\textsuperscript{10-12}. Pulmonary function results were expressed as both absolute and percentage of reference values. The reference values used were those of Polgar\textsuperscript{13} for children and Morris\textsuperscript{14} for adults, and were based on standing height. Follow-up assessments were always performed at the same facility. PFTs were performed seated and wearing nose clips, in a Sensormedics Vmax V6200 Autobox (Sensormedics, Viasys Healthcare, Yorba Linda, USA) calibrated prior to each test, to a volume measurement accuracy of $\pm 3\%$\textsuperscript{10}.

**Statistical Analysis.** Distributions of FVC, FEV$_1$ and TLC for the patient group were assessed by evaluating skew and kurtosis (statistical measures describing the distribution of a dataset), and on the basis of these results, Wilcoxon signed ranks test were used to test for significant differences between non-parametric variables. Specifically, each PFT measurement was tested against every subsequent assessment to examine changes in pulmonary function for all pairs of time intervals. Mean FVC, FEV$_1$ and TLC results were plotted versus time, and compared with values reported by Faro et al.$^2$ and Graham et al.$^3$. Percentage changes in FVC, FEV$_1$ and TLC relative to pre-operative values were also charted versus follow-up time. Pearson correlation coefficients were calculated to look for significant relationships between overall pulmonary function improvements (two year post-op minus pre-op value for FEV$_1$, FVC, TLC, FEV$_1\%$, FVC$_\%$, TLC$_\%$) and either percent Cobb correction or the number of instrumented levels.

**Results**

The study cohort included 39 patients with thoracic adolescent idiopathic scoliosis (AIS) and 5 neuromuscular scoliosis patients (syringomyelia diagnosed with MRI) who underwent anterior endoscopic spinal instrumented fusion. Mean age at surgery was 15.4 years (range 10.8-38.5), with 38 females and 6 males. 41 of the major curves were convex to the right and 3 were convex
to the left. The cohort included 25 Lenke 1A curves, 6 1B curves, 4 1C curves, 2 2A curves, 1 4A curve and 1 5A curve. Patients had an average of 6.6 levels instrumented (range 5–8). Mean preoperative Cobb angle was 49.9° (range 35°–66°), corrected surgically to 20.6° (range 6°–34°), resulting in a mean curve correction of 58.7%. Mean postoperative instrumented Cobb angle was 18.2° (range 3° to 34°), for a mean (instrumented) curve correction of 63.5%. Mean T5-T12 kyphosis was +16.4° (range -13° to +42°) preoperatively, and +28.0° (range +15° to + 46°) postoperatively, for a mean increase in sagittal thoracic kyphosis of 70.4%. Mean preoperative and postoperative rib hump measurements were 16° (range 7°-30°) and 6° (range 2°-12°) respectively, for a mean rib hump correction of 61.6%. Mean Risser sign at surgery was 2.95 (range 0–5). The mean increase in height between preoperative and three month postoperative measurements was 8mm (range -10 to +25mm). Mean increase in height between three month and 24 month follow-up assessment was 16mm (range 0-90mm).

Figures 1 and 2 give trends of mean pulmonary test parameters (FVC, FEV₁ and TLC) versus time for both absolute and percent of reference values, compared with existing data from Faro et al.² following endoscopic anterior surgery. Figures 3 and 4 compare the same results with pulmonary function data from Graham et al.³ for open thoracotomy. Figures 5, 6 and 7 give the percentage change in pulmonary function at each follow-up interval compared with pre-operative values for both absolute and % reference values. Tables 1 and 2 give Wilcoxon signed ranks test results for each pair of measurements, with arrows used to indicate statistically significant (p<0.05) increases (↑) or decreases (↓) in pulmonary function between pairs of assessments. For example, Table 2 shows a statistically significant increase in FVC (p=0.016) between 12 and 24 months post-operatively.
Significant correlations (P<0.05) occurred between FVC and % Cobb correction (r=0.42), TLC and % Cobb correction (r=0.45), TLC% and % Cobb correction (r=0.47), FEV$_1$ and number of instrumented levels (r=0.42).

**Discussion**

Endoscopic anterior correction of scoliosis is an established procedure with perceived benefits (with respect to open thoracotomy) of improved cosmesis and reduced surgical trauma to the chest. Previous studies$^{1,2,4}$ have shown that thoracoscopic approaches cause less decline in pulmonary function three months and 12 months after surgery compared to open thoracotomy with comparable curve corrections, and that pulmonary function returns to (and may increase slightly above) pre-operative levels between 12 and 24 months postoperatively. This study substantiates the recent findings of Newton et al.$^4$ and Faro et al.$^2$ by evaluating complete pulmonary function test results (FVC, FEV$_1$ and TLC – total lung capacity) for multiple assessment intervals up to and including two years post-surgery. Statistical comparisons between all pairs of pulmonary function results are used to provide a guide for surgeons and their patients as to how pulmonary function recovers during the two years following endoscopic anterior scoliosis instrumentation.

Figure 1 shows close agreement between the present study and data from Faro et al.$^2$ for FVC and FEV$_1$ at three and 12 months post-surgery. The additional six month data in this study shows that recovery is not linear between three and 12 months post-operatively, so that greater improvement in pulmonary function occurs between 3-6 months than between 6-12 months. In our study, absolute FVC has returned to preoperative levels by 12 months and FEV$_1$ values have exceeded
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preoperative levels by 12 months. Furthermore, FVC and FEV\textsubscript{1} both continue to increase from 12-24 months post-surgery so that values at 24 months are higher than preoperative values.

In addition to FVC and FEV\textsubscript{1} used in the previous studies, the present study included TLC assessment. Absolute values for TLC in Figure 1 show a sharp decline between preoperative measures and 3 months (similar to that of FVC and FEV\textsubscript{1}), followed by gradual recovery. TLC returns to preoperative values by 24 months with the most rapid improvement again occurring between 3 and 6 month follow-ups.

The comparison with Graham et al’s open thoracotomy data in Figure 3 shows very similar pre-operative and two year post-operative absolute values to our study, but distinctly different recovery curve shapes between these endpoints. Graham et al’s percent predicted values in Figure 4 also show different recovery curve trends, with recovery at two years not reaching pre-operative levels. We note that Graham et al’s data is based on a demographically similar patient group to our own, so that the differences in pulmonary function recovery may be attributable to the differences in surgical procedure.

The mean increase in patient height between pre-op and 3 months post-op would be expected to comprise a surgical correction component and a (small) growth component, whereas the larger height increase from 3-24 months comprises solely post-operative growth. Increases in absolute pulmonary capacity beyond pre-operative levels are therefore most likely due to a combination of improved thoracic shape and continued growth post-surgery. Growth effects are accounted for by using height-matched reference values (Figure 2). The present study again shows similar trends to Faro et al.\textsuperscript{2} with an initial decline at 3 months followed by steady improvement until 12
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months. Faro et al’s percent reference (FVC% and FEV$_1$%) values have not yet returned to pre-operative levels by 12 months, but our results show a return to pre-operative values by 12 months for FVC%, while FEV$_1$% exceeds pre-operative levels by a small amount and TLC% is still slightly reduced at 12 months. TLC% returns to preoperative levels by 24 months and both FVC% and FEV$_1$% continue to improve beyond pre-operative levels between 12 and 24 months. These increases in percent reference pulmonary function beyond pre-operative levels imply that endoscopic scoliosis surgery has a similar beneficial effect on pulmonary function to that previously documented for posterior surgery. Gagnon et al. and Lenke et al. attributed improvements of 12-15% in FVC in the 12 to 24 months postoperatively to the three-dimensional correction provided by the posterior instrumentation. We hypothesize that the improvement in this study following endoscopic anterior instrumentation is attributable to the enhancement of thoracic cavity shape provided by the procedure, together with minimal tissue disruption. Newton et al. (2005) report a small, statistically significant increase in absolute FEV$_1$ values at two years but only a return to preoperative values for FVC% and FEV$_1$%. Our study found slightly greater improvements in pulmonary function, so that mean two-year percent reference (growth corrected) values are up to 5% higher than preoperative levels.

As previously mentioned, 3 of the 44 patients underwent thoracoplasty as part of their surgical procedure. Due to the small size of this subset, separate statistical analysis was not attempted. However, inspection of the pulmonary function data for these three patients did not suggest a noticeable discrepancy compared to the non-thoracoplasty group.

The use of standing height to regress against reference values for normal populations is a potential weakness of studies involving spinal deformity patients due to the effect of the
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deformity on erect posture. Ideally, the choice of reference equation should be matched to the
population studied\textsuperscript{15}. Very few studies use arm span to regress pulmonary function values,
although this may be a superior anthropometric measure for scoliosis studies. Recently, reference
equations using ulna length have become available, and their use may prove beneficial in future
investigations\textsuperscript{16}. Tracking pulmonary function changes over time in skeletally immature children
is complicated by progressive lung growth. Although charts of lung growth have been
developed\textsuperscript{17}, the percent of reference approach used in this study is currently preferred for
children and adolescents\textsuperscript{15}. \(Z\), \(SD\), or \(RSD\) score deviations have also been used to evaluate lung
volume changes during growth\textsuperscript{18,19}.

Figures 5-7 allow ready comparison with preoperative levels, showing that pulmonary function
decreases by approximately 10\% at three months post-surgery, and then (depending on the
parameter being measured) either returns to pre-operative levels (TLC) or increases beyond pre-
operative levels (FVC and FEV\textsubscript{1}). FVC has the largest decline at both 3 and 6 month follow-ups,
and FEV\textsubscript{1} shows the largest overall improvement, with absolute FEV\textsubscript{1} increasing by 8\% relative
to pre-operative values and percent reference FEV\textsubscript{1} 4.8\% above pre-operative values at 24
months follow-up. Previous authors\textsuperscript{3,8,20} have reported persistent reductions in percent reference
pulmonary function two or more years following open anterior scoliosis surgery, however this
study suggests that endoscopic anterior scoliosis surgery results in two year percent reference
values (FVC\% and FEV\textsubscript{1}\%) exceeding preoperative levels by 3-5\%.

In this study, PFT results were found to be non-normally distributed across the patient group
based on evaluation of skew and kurtosis for FVC, FEV\textsubscript{1} and TLC. Statistical analysis tools
assuming normally distributed data were therefore not suitable, and Wilcoxon signed ranks tests
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were used to test for significant differences between pairs of pulmonary test results for both absolute and percent of reference values. The statistical analysis in Table 1 shows that decreases in absolute FVC (relative to preoperative levels) were statistically significant at both 3 and 6 months. The improvement in FVC between pre-operative and 24 month values was statistically significant, as was the increase between 12 and 24 month values which has not been previously reported. Supporting the recent findings of Newton et al. (2005), our study also found that absolute FEV\(_1\) values at two years post-surgery demonstrate a small but significant increase over preoperative levels. Absolute TLC values are significantly reduced at both 3 and 6 months relative to pre-operative levels, but significant improvements occur between 3-6 months and 6-12 months follow-up. There was no significant improvement in TLC between 12 and 24 months.

Table 2 applies Wilcoxon signed ranks tests to percent of reference PFT results, thereby taking into account the growth of subjects during the two year follow-up period. The post-surgical decrease compared to preoperative values was significant for all test parameters at 3 months and for both FVC\(\%\) and TLC\(\%\) at 6 months. Significant improvements in FVC\(\%\) and FEV\(_1\)\(\%\) occurred between 3-6 months, 3-12 months and 3-24 months as well as from 6-12 months and 6-24 months. Increases in TLC\(\%\) were significant from 3-12 months, 3-24 months and 6-24 months but not from 3-6 months. In summary, increases in percent reference pulmonary function between successive follow-up tests are all significant with the exception of 3-6 month TLC\(\%\) and 12-24 month FVC\(\%\), FEV\(_1\)\(\%\) and TLC\(\%\).

On the basis of the successive improvements in absolute FVC from 3-6, 6-12 and 12-24 months, patients could therefore be advised that pulmonary tolerance to physical exertion should continually improve from 3 months to 24 months following surgery. On the basis of the two year
follow-up results, endoscopic anterior scoliosis instrumentation has no lasting negative effect on pulmonary function and with prolonged follow up, pulmonary function increases beyond preoperative levels. This effect may be due to the endoscopic approach or to the scoliosis correction itself.

Statistically significant correlations were found between the extent of curve correction, the number of instrumented levels, and some pulmonary parameters. However, the correlation coefficients in these cases were generally low, and the correlations were not consistent across all pulmonary function parameters.

In conclusion, following a decline of approximately 10% at 3 months post-surgery, FVC and FEV$_1$ both recover to exceed preoperative levels by 5-8% between 12 and 24 months post-surgery, while TLC returns to preoperative levels.
Figure Captions

Figure 1. Comparison of trends in absolute FVC, FEV₁ and TLC versus time following endoscopic anterior scoliosis surgery with data from Faro et al.²

Figure 2. Comparison of trends in percent reference FVC, FEV₁ and TLC versus time following endoscopic anterior scoliosis surgery with data from Faro et al.²

Figure 3. Comparison of trends in absolute FVC, FEV₁ and TLC versus time following endoscopic anterior scoliosis surgery with data from Graham et al.³ for open thoracotomy

Figure 4. Trends in percent reference FVC, FEV₁ and TLC versus time following endoscopic anterior scoliosis surgery with data from Graham et al.³ for open thoracotomy

Figure 5. Changes in both absolute and percent reference FVC versus time following endoscopic anterior scoliosis surgery.

Figure 6. Changes in both absolute and percent reference FEV₁ versus time following endoscopic anterior scoliosis surgery.

Figure 7. Changes in absolute and percent reference TLC versus time following endoscopic anterior scoliosis surgery.
References


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Percentage Predicted (%)

- FVC
- FEV1
- TLC
- Faro et al, 2005 (FVC%)
- Faro et al, 2005 (FEV1%)

pre-op 3 months 6 months 12 months 24 months
Post-op follow up (months)

% change from pre-op FVC

-15% -10% -5% 0% 5% 10% 15%

3 6 12 24

FVC
FVC%

FVC: Functional Vital Capacity
FVC%: Percentage change from pre-op FVC
Post-op follow up (months)

% change from pre-op FEV1

- FEV1
- FEV1%

% change from pre-op FEV1

3 6 12 24

Post-op follow up (months)
**Table 1.** Wilcoxon signed ranks tests for forced ventilatory capacity (FVC), forced expiratory volume in one second (FEV\(_1\)), and total lung capacity (TLC). \(n\) is the number of paired datasets in each test, \(z\) is the \(z\)-statistic based on negative ranks, and \(p\) is the significance level (two-tailed). * denotes significant differences at the 0.05 level. Arrows denote whether respiratory function has increased (↑) or decreased (↓) for time intervals with statistically significant changes. Row titles refer to the starting point of the time interval to be assessed, and column titles the endpoint. For example, the intersection of row “3 month FVC” and column “12 months” compares changes in FVC between 3 and 12 months post-operatively.

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<th>12 months</th>
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<td><strong>12 month TLC</strong></td>
<td>(n=23)</td>
<td></td>
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<tr>
<td>(z=-1.020)</td>
<td></td>
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<tr>
<td>(p=0.308)</td>
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</table>
Pulmonary function after endoscopic scoliosis surgery

Table 2. Wilcoxon signed ranks tests for % reference value forced ventilatory capacity (FVC%), forced expiratory volume in one second (FEV₁%), and total lung capacity (TLC%). n is the number of paired datasets in each test, z is the z-statistic based on negative ranks, and p is the significance level (two-tailed). * denotes significant differences at the 0.05 level. Arrows denote whether respiratory function has increased (↑) or decreased (↓) for time intervals with statistically significant changes. Row titles refer to the starting point of the time interval to be assessed, and column titles the endpoint. For example, the intersection of row “3 month FVC%” and column “12 months” compares changes in % reference FVC between 3 and 12 months post-operatively.

<table>
<thead>
<tr>
<th></th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
<th>24 months</th>
</tr>
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<tbody>
<tr>
<td><strong>Pre-op FVC%</strong></td>
<td></td>
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<tr>
<td>n=19</td>
<td>z=-3.226</td>
<td>p=0.001*↓</td>
<td>n=36</td>
<td>z=-0.118</td>
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<td>z=-2.187</td>
<td>p=0.029*↓</td>
<td></td>
<td>p=0.906</td>
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<tr>
<td></td>
<td>n=36</td>
<td>z=-0.118</td>
<td>p=0.906</td>
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<td>n=28</td>
<td>z=-1.403</td>
<td>p=0.161</td>
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<tr>
<td><strong>3 month FVC%</strong></td>
<td>n=16</td>
<td>z=-3.263</td>
<td>p=0.001*↑</td>
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<tr>
<td></td>
<td>n=18</td>
<td>z=-3.731</td>
<td>p&lt;0.001*↑</td>
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<tr>
<td></td>
<td>n=11</td>
<td>p=0.003*↑</td>
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<tr>
<td><strong>6 month FVC%</strong></td>
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<td>z=-3.616</td>
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<td>z=-3.490</td>
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<td>p=0.359</td>
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<td><strong>Pre-op FEV₁%</strong></td>
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<td>p=0.380</td>
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<td>z=-3.083</td>
<td>p=0.002*↑</td>
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<td>z=-3.731</td>
<td>p&lt;0.001*↑</td>
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<td>n=11</td>
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<td>p=0.201</td>
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<td><strong>Pre-op TLC%</strong></td>
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<td>n=16</td>
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<td>p=0.157</td>
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<td>z=-1.415</td>
<td>p=0.732</td>
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<td>z=-1.920</td>
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<td>z=-2.851</td>
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<td>z=-1.345</td>
<td>p=0.179</td>
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</table>