Space between the titanium plate of zero-profile cage and endplate of the vertebral body might affect the fusion process in anterior cervical discectomy and fusion

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To the Editor: Anterior cervical discectomy and fusion (ACDF) is a “gold standard” for patients with spondylotic myelopathy when conservative treatments fail.¹ A zero-profile, standalone device (Zero P; Synthes GmbH, Zuchwil, Switzerland) is more popular than the traditional plate and cage for ACDF.² Yun et al³ showed that the insertion point of Zero-P in the intervertebral disc space might be an important factor for maintenance of anterior disc height. However, no consensus exists regarding the position related to better clinical and radiological results.

A space usually exists between the titanium plate of Zero-P and endplate of the vertebral body (TPE) along the anterior vertebral line on a lateral X-rays. In clinical practice, the endplate is polished to enable insertion of Zero-P in case of large anterior osteophytes. This facilitates the contact of the posterior polyetheretherketone (PEEK) cage with the superior and inferior endplate, thus, accelerating the fusion process. Thus, TPE space is formed. For patients without severe degeneration, Zero-P can be easily inserted without excessive preparation of the endplates, and the zero-profile titanium plate is perfectly matched with the operated levels.

Therefore, we hypothesized that the presence of TPE space would affect the prognosis. The purpose of our study was to determine whether the presence of TPE space hastened the fusion process, sacrificing the maintenance of Cobb C, Cobb S, and IDH.

This study was approved by the Institutional Ethics Committee (No. 2019-567), and all patients provided written informed consent. Between January 2011 and December 2018, 80 patients who underwent single-level ACDF using zero-profile devices were retrospectively reviewed and assigned to two groups based on presence of TPE space on the radiograph. A total of 41 and 39 patients with TPE space along the anterior vertebral line and without TPE space were classified into groups A and B, respectively.

All operations were performed by the same surgeon using the classical Cloward approach. In group A, the endplates were overpolished to facilitate contact between the posterior cage and cranial and caudal vertebrae with TPE space along the anterior vertebral line. In group B, the endplate was not overpolished, and the implant was perfectly matched with the endplates to eliminate the TPE space. On completion of the decompression, an appropriate Zero-P was selected and perfectly matched with the operated levels.

All patients were reviewed post-operatively at 3, 6 months, 1 year, and every year thereafter. Japanese Orthopedic Association (JOA) score, neck disability index (NDI), and visual analog scale (VAS) score were assessed before and after the surgery to analyze the neurological status, neck function, and pain intensity, respectively.⁴ Cobb C, Cobb S, and IDH were determined using radiographs. Presence of fusion was determined using radiographs and computed tomography.

SPSS for Mac Version 25.0 (IBM Corporation, Armonk, NY, USA) was used for statistical analysis. Continuous normal distribution variables were expressed as mean ± standard deviation. Non-normal distribution variables were expressed as median (range). The independent t test or the non-parametric Mann-Whitney U test were used to compare continuous data between both groups, depending on the distribution.
on whether the data were normally distributed or not. The categorical variables were assessed using the Pearson Chi-square test or Fisher exact test. The paired t test was used to analyze changes between the pre-operative and post-operative parameters. P value < 0.05 was considered to be statistically significant.

Eighty patients, including 41 men and 39 women, with an average age of 51.7 years were followed up clinically and radiographically for a minimum of 12 months, with median follow-up of 15 months (range: 12–90 months). Majority of patients showed symptom relief post-operatively. Significant improvement in JOA was seen, and VAS and NDI significantly decreased post-operatively. However, no significant differences in JOA, NDI, and VAS were seen between the two groups at any follow-up point [Table 1]. Pre-operative and immediate post-operative Cobb C, Cobb S, and IDH in group A was inferior to that in group B because TPE space weakened the support of the titanium plate. One patient in group A and two in group B failed to achieve solid fusion at last follow-up. Further, the overall fusion rate at the last follow-up showed no significant difference (P = 0.965). However, the fusion process in group A was faster than that in group B, with significant difference (P < 0.0001) [Table 1]. This is because group A with TPE space had more contact and compression between posterior PEEK cage and endplates.[3]

The insertion point and composition of the zero-profile anchored spacer plays an indispensable role in maintaining Cobb C, Cobb S, and IDH. Appropriate positioning of the titanium plate along the anterior vertebral line would maintain Cobb C, Cobb S, and IDH because the strength of the anterior cortical corner may be greater than that in the other parts of the endplate.[3] Group A with TPE space signifies absence of contact between the titanium plate and endplate, and supporting strength is mainly provided by the cage; thus Cobb C, Cobb S, and IDH may show greater decrease than that with group B with perfect match between the titanium plate of Zero-P cage and endplate of vertebral body.

In conclusion, presence of TPE space can facilitate posterior PEEK cage contact the upper and lower endplates, resulting in quicker fusion process but sacrificing the Cobb C, Cobb S, and IDH at the same time. However, this small difference does not affect clinical outcomes.

**Table 1: Clinical and radiographic results of all patients with anterior cervical discectomy and fusion in this study.**

| Parameters | Group A (n = 41) | Group B (n = 39) | t/z | P |
|------------|-----------------|-----------------|-----|---|
| JOA | | | | |
| Pre-operative | 9.17 ± 2.46 | 8.79 ± 2.44 | 0.69 | 0.492 |
| Immediate post-operative | 12.66 ± 2.15 | 12.31 ± 1.99 | 0.73 | 0.465 |
| Last follow up | 15.34 ± 1.92 | 15.16 ± 1.48 | 0.47 | 0.637 |
| VAS | | | | |
| Pre-operative | 7.17 ± 1.87 | 7.10 ± 1.86 | 0.16 | 0.871 |
| Immediate post-operative | 3.39 ± 1.56 | 3.20 ± 1.47 | 0.55 | 0.588 |
| Last follow up | 1.43 ± 0.71 | 1.52 ± 0.94 | 0.40 | 0.692 |
| NDI | | | | |
| Pre-operative | 32.49 ± 3.34 | 32.80 ± 2.62 | 0.33 | 0.745 |
| Immediate post-operative | 19.29 ± 3.26 | 18.87 ± 2.90 | 0.45 | 0.658 |
| Last follow up | 7.80 ± 1.78 | 8.13 ± 1.77 | 0.61 | 0.542 |
| Cobb C (°) | | | | |
| Pre-operative | 7.77 ± 6.88 | 8.52 ± 9.59 | 0.41 | 0.686 |
| Immediate post-operative | 15.13 ± 6.83 | 15.57 ± 7.39 | 2.71 | 0.087 |
| Last follow up | 10.30 ± 6.74 | 13.52 ± 6.81 | 2.10 | 0.042 |
| Cobb S (°) | | | | |
| Pre-operative | 1.37 (-12.91–11.87) | 1.79 (-15.17–16.11) | 0.60 | 0.546 |
| Immediate post-operative | 3.51 (-10.29–15.26) | 3.71 (-2.12–16.54) | 0.02 | 0.984 |
| Last follow-up | 2.09 (-12.67–13.97) | 2.68 (0.93–14.98) | 1.64 | 0.101 |
| IDH (cm) | | | | |
| Pre-operative | 0.40 ± 0.09 | 0.40 ± 0.08 | 0.18 | 0.861 |
| Immediate post-operative | 0.86 ± 0.15 | 0.83 ± 0.09 | 1.15 | 0.252 |
| Last follow-up | 0.69 ± 0.10 | 0.78 ± 0.07 | 4.60 | <0.0001 |
| Fusion, n | | | | |
| 3-month | 11 | 3 | | |
| 6-month | 25 | 18 | | |
| 12-month | 4 | 16 | | |

Continuous parameters were presented as mean ± standard deviation (SD). Non-normal distribution parameters were presented as median (range). JOA: Japanese Orthopedic Association; VAS: Visual analog scale; NDI: Neck disability index; IDH: Intervertebral disc height.
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Conflicts of interest
None.

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