Peer Review File

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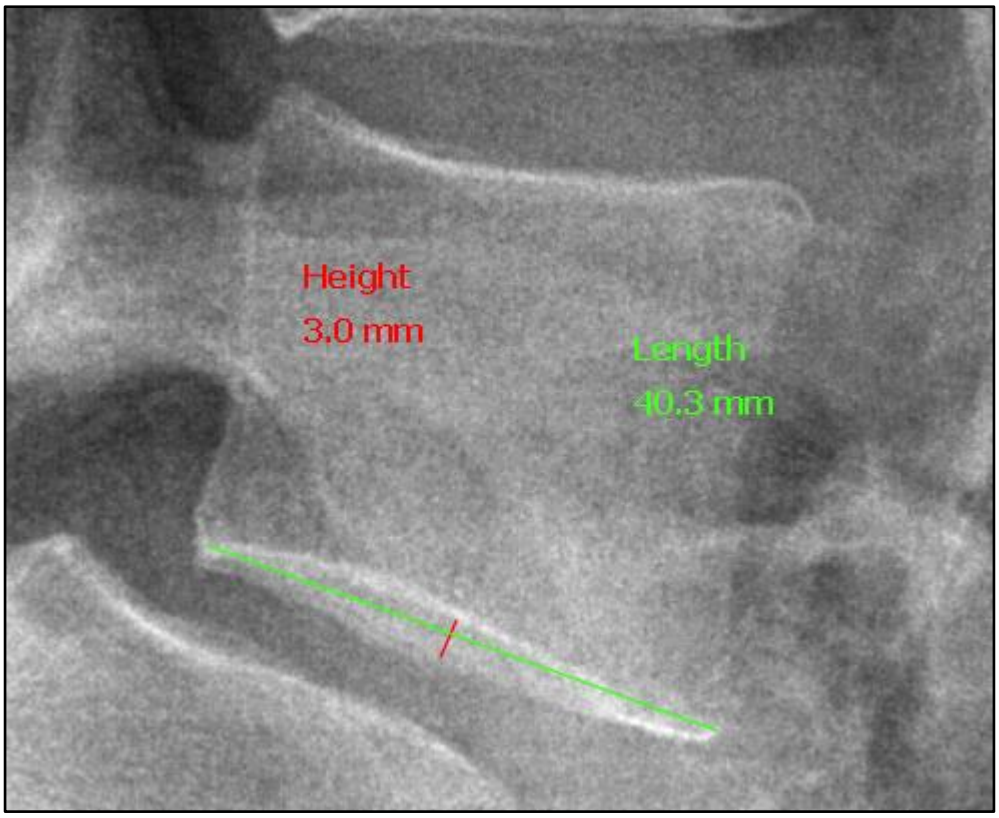
**Reviewer Comments**

*The authors did an excellent job of highlighting the comparable advantage of using expandable interbody over the static one. Interbody spacers are generally used to restore disc height and improve spinopelvic alignment by introducing lordosis. The results discussed by the authors clearly demonstrate that disc height is improved across all antero-posterior points of the vertebral bodies.*

*As explained in this article, Altera cage has a unique articulating feature that allows the spacer to be positioned in ideal location with good surface area. Although data is somewhat limited by the small sample size, this article provides valuable evidence to spine surgeons.*

Comment 1: *However, this article needs to provide additional details and elucidate potential for significant biases. Most importantly, how did authors make sure that disc height and lordotic angles are accurately recorded? I assume the authors used standing X-ray lateral view (if correct, please indicate in the article) to measure their outcomes. However, this can often be difficult because vertebral endplates in sagittal X-ray are often not parallel and appear as oval shapes instead of straight lines. This is particularly an issue in scoliotic patient (relatively common in patients with lumbosacral degenerative disease). How did authors address this problem?*

Reply 1: We thank the reviewer for their comments and hope to be able to address them. All radiographic parameters were measured using standing lateral X-rays. The patients chosen for this study were treated at a single level only, and no patients included in the analysis were diagnosed with the type of scoliotic deformities the reviewer refers to in their comment. Care was taken by the radiologist to attain clear shots of the target level and as a result, most of the images measured had fairly “parallel” endplates, as the reviewer mentions. To illustrate this, the authors measured the oval shapes of 184 study images, as the graphic below describes, with the average height (red) of the ovals being 2.79mm, the average length (green) of the ovals being 40.53mm, and height was 7% of the length. The image below is a relatively representative image that can demonstrate what these figures mean. Further consideration of these values suggests this average oval height value can be seen as an average error margin of disc height measurements, with the upper edge of the oval as a higher limit and the lower edger as a low limit of where the measurer might place their disc height line. This would mean the real values would be off by only about plus or minus half the average oval height, or 1.4mm. This is a relatively small amount of error. We hope this addresses the reviewer’s concern regarding the quality of imaging in this study.




Changes in text:
Edited sentence in methods section on page 5, lines 77–79, to read:
Radiographic parameters including disc height, neuroforaminal height, intervertebral angle, segmental lordosis, and lumbar lordosis were assessed preoperatively and at 6 weeks, 3 and 6 months, and final follow-up postoperatively from standing lateral plain film radiographs.

Comment 2: *Also, it is not clear how the 48 patients are chosen. How did the authors come up with 2 groups of such sample size?*

Reply 2: Patients in this study were retrospectively collected from consecutive patients having undergone single-level TLIF surgery. Further information on how the study subjects were chosen has been added to the manuscript.

Changes in text:
Added the following to page 5, lines 70–74:
The study groups were retrospectively collected from consecutive patients having undergone primary single-level static TLIF surgery between March 2010 and March 2012 or primary articulating expandable single level TLIF surgery between October 2015 and October 2016. Patients were excluded for missing preoperative data (1) or missing 6-month follow-up data (5).

Comment 3: *How did 2 groups differ in terms of the surgical level, patient comorbidities, and so forth?*

Reply 3: Groups did not differ in patient age, gender, BMI, surgical levels, or diagnosis. Comorbidities are listed in *Table 2*.

Changes in text:
The addition of a p value column has been made to *Table 1* to show that the groups did not differ on these demographics.

**Table 1:** Baseline Characteristics

| Parameter | Articulating Expandable | Static | *p* value |
|---|---|---|---|
| Number of Patients | 27 | 21 | |
| Gender | | | |
| Female, n (%) | 12 (44.4%) | 12 (57.1%) | 0.561 |
| Male, n (%) | 15 (55.6%) | 9 (42.9%) | |
| Age, mean ± SD, (range) | 55.7±9.5 (34–70) | 52.1±11.9 (29–76) | 0.180 |
| Body Mass Index | 29.7±5.1 (20–41) | 29.7±4.4 (21–37) | 0.967 |
| Average Follow-up | 9.1 months | 16.0 months | |
| Levels Treated, n (%) | | | |
| L3–L4 | 3 (11.1%) | 0 (0.0%) | |
| L4–L5 | 10 (37.0%) | 10 (47.6%) | 0.264 |
| L5–S1 | 14 (51.9%) | 10 (47.6%) | |
| L6-S1 | 0 (0.0%) | 1 (4.8%) | |

The following has been added to the Materials and methods section (page 7, lines 116–118) to describe how these differences were tested:
Patient age and BMI were compared using Mann-Whitney U tests. Patient diagnosis and surgical level were compared with chi-squared tests. Patient gender was compared with Fischer's exact test.
The following has been added to the Results section at page 8, lines 130–133:
Reported comorbidities (static, expandable) included hypertension (42.9%, 51.9%), diabetes (9.5%, 3.7%), cancer (0%, 7.4%), arthritis (0%, 11.1%), osteoporosis (0%, 3.7%), gout (0%, 7.4%), depression (4.8% 14.8%), bipolar (0%, 7.4%), smoker (9.5%, 0%), history of drug abuse (0%, 3.7%).

Comment 4: *What static spacers were used?*

Reply 4: A breakdown of the implants in this study is located in the table below:

| | Number | Percent |
|---|---|---|
| Altera | 27 | 56.3 |
| Pioneer PEEK | 13 | 27.1 |
| Nuvasive PEEK | 4 | 8.3 |

| | | |
|---|---|---|
| Medtronic Capstone | 4 | 8.3 |
| Total | 48 | 100.0 |

Comment 5: *Was there a surgeon using only altera cage which would introduce significant surgeon bias?*

Reply 5: Yes, the ALTERA® data came from one surgeon, the static data from another. The reviewer is correct that this may have introduced surgeon bias into the data; however, the patients underwent similar procedures and were similar in age, gender, BMI, levels instrumented, and diagnosis.

Comment 6: *Who were the two different observers that recorded outcome? Was the verifying orthopedic surgeon associated with globus in any way (i.e. utilizes altera cage, or in financial relationship with Globus)?*

Reply 6: The individuals that measured the radiographs were trained by an orthopedic surgeon to measure radiographic parameters, and the individuals are a coauthor on other published studies who also had abstracts accepted at a number of spine-related academic conferences including GSC, AANS, ISSLS, NASS, NASS Summer Spine, LSRS, World Congress, SOLAS, CNS, and SMISS. The observers and verifying orthopedic surgeon were employees of the Musculoskeletal Education and Research Center (MERC), a division of Globus Medical, Inc.

Kremer, M.A., Alferink, J., Wynsma, S., **Shirk, T.** and **Ledonio, C**., 2019. Expandable spacers provide better functional outcomes than static spacers in minimally invasive transforaminal lumbar interbody fusion. Journal of Spine Surgery, 5(3), p.315.

Frisch R, **Shirk T, Ledonio C.** Static versus Expandable Interbody Spacers: Final 2-Year Clinical and Radiographic Results. J Clin Neurol Neurosurg Spine. 2019; 4(1): 1018.

Vardiman, A.B., Wallace, D.J., Booher, G.A., Crawford, N.R., **Riggleman, J.R.**, Greeley, S.L. and **Ledonio, C.G.**, 2020. Does the accuracy of pedicle screw placement differ between the attending surgeon and resident in navigated robotic-assisted minimally invasive spine surgery?. Journal of robotic surgery, 14(4), pp.567-572.

Huntsman, K.T., Ahrendtsen, L.A., **Riggleman, J.R.** and **Ledonio, C.G.**, 2020. Robotic-assisted navigated minimally invasive pedicle screw placement in the first 100 cases at a single institution. Journal of Robotic Surgery, 14(1), pp.199-203.

Comment 7: *Overall, I believe this article provides clinically important data for expandable interbody spacers. It just needs to provide some additional explanations and details.*

Reply 7: The authors thank the reviewer for their time and attention. We believe this research provides clinically important data relevant to practicing surgeons, and we hope that we have provided the explanations and details needed to bring this work to publication.