Author's response to reviews

Title: Minimally Invasive Scoliosis Surgery in Adolescent Idiopathic Scoliosis: Surgical Technique

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Author's response to reviews:

Please see comments below:

Reviewer 1:

1. No question is asked in this article. Only a technical description of a "new" MIS procedure in unreported indication
   - Purpose of the study has been added to lines 46-48

2. The technical approach is well described with sufficient detail to be replicate but little information is associated to this description to allow us to choose the number of levels to instrumented and fused, the selection of the type of screw based on the degree of deformity, on the flexibility of the curve, ect.... They speak about "preference" with no more explanation of justification. They promote hand-free technique, no EMG monitoring but use SSEP and transcranial MEP monitoring without any explanation or clinical results.
   - Explanation for screw choice is detailed in lines 97-102
   - Use of SSEP monitoring and anatomic free-hand technique are both well established in spinal surgery and are beyond the scope of this study.

3. Results are restricted in two short cases reported, authors don't precise if those are the only cases performed or selected out of a larger experience. They don't precise if, in those selected cases, they have used SSEP, hand-free screw placement procedure, ect... Were those patients selected on some criteria?
   - Patient selection criteria are detailed in line 157
4. Discussion give no relevant information based on the literature (MIS, MIS and scoliosis) whereas all references are available in the list of references. In discussion, authors raise some aspect that have not be used in the technical description and case report so as using BMP in patient of childbearing age, complications associated with BMP. In opposite, no discussion based on MIS aspect of this approach is given (blood loss, soft tissue preservation, postoperative pain, operative time...)

- BMP is discussed in lines 103-104 of “Surgical Technique” section and lines 171-181 of the “Discussion” section

5. Title is correct but abstract included some data suggested ("There are multiple advantages of this technique, including: less blood loss, shorter hospital stay, earlier mobilization, and relatively less pain and need for pain medication. The operative time needed to complete this surgery is longer. ") but that we can not find in the article.

Authors give there "feeling " on a complex MIS approach in a new and complex indication (multilevel MIS procedure) base on an experience of 2 cases without any clinical information and outcome described.

- Study is meant as a technique description and agrees that further data will be needed to assess the long-term viability of this procedure. Analysis of perioperative parameters for cases utilizing this MIS technique will be provided in a future publication.

Reviewer 2:
1. I am surprised at the use of Toradol for pain management in spinal fusion patients. Glassman et al, has found that Toradol leads to non-union in spinal fusion surgery. While this may not be the case in children / adolescents, this issue requires discussion.

- Addressed in lines 183-194

2. Figure 5 is out of focus and should be reshot or eliminated.

- Figure 5 has been eliminated.

3. Beginning with Figure 10, the numbers on the images do not correlate with the Figure number. This needs to be address.

- Figure numbers have been edited and corrected appropriately.

Reviewer 3:
Clinical Data: (1,2,3,4)

- Study is meant as a technique description and agrees that further data will be needed to assess the long-term viability of this procedure. Clinical data and analysis of perioperative parameters for cases utilizing this MIS technique will be provided in a future publication.

Technique:

1. The authors need to describe how the access to the intervening segment is obtained in a satisfactory way so as to perform an adequate osteotomy, facet resection and preparation of the fusion bed
   - Description is in lines 80-84

2. What pedicle screw instrumentation system is used
   - Discussed in lines 95-96

3. What does the author mean by MIS screw with open connector and a reduction screw as Figure 4 shows the same screw with a different attachment?
   - Figure shows different screws, not same screw

4. Given the amount of retraction needed the reviewer is concerned as to the incidence of skin necrosis with this technique and unsightly scarring in this adolescent population
   - Commented on in lines 130-131 and lines 168-170

5. The passage of the rod subfascial is critical to prevent muscle tethering and necrosis. How exactly do the authors manage this especially in the intervening segment?
   - Discussed in lines 116-118

6. The dose of RhBMP2 if used would be important to know and also when do the authors decide to use the same and on how many patients was it used.
   - Commented on in lines 179-181

7. The adequacy, tensile strength and the quality of the bone fusion mass all remain very concerning with this technique
   - Study is meant as a technique description and agrees that further data will be needed to assess the long-term viability of this procedure. Clinical data, fusion quality/maintenance, and analysis of perioperative parameters for cases utilizing this MIS technique will be provided in a future publication
8. The figures and legends do not correspond especially with reference to 10 a,b,c,d and similarly Figure 11 a,b,c

- Corrected appropriately.

9. All figures subsequent to this are of sequence

10. The first patients post-operative picture continues to show right shoulder elevation and significant coronal imbalance to the left. & 11. The second patient also has an elevated right shoulder with decompensation to the left & 12. Both patients also show significant flattening of their sagittal profile as compared to pre-op and the second patient is in sagittal decompensation & 13. This truly raises concern as to the adequacy of correction especially with regards to correction of the thoracic prominence and maintenance of sagittal profile & 14. Also the post-operative films appear to be immediate post-op films and follow-up radiographs would be very useful to see as the authors have at least a year of experience with this technique

- Figures for first patient have been change to more recent follow-up images (New Figures 10 & 11, follow-up nearly 2 years). At follow-up, it is clear that shoulder imbalance has leveled, coronal balance is maintained, and sagittal profile has not significantly flattened. Pedicle screws by nature have a hypokyphosis effect, and thus any imbalance is not an issue with the MIS technique. Sagittal imbalance may generally be a problem of level selection, not surgical technique. Furthermore, positioning of arms during imaging can significantly affect perception of sagittal imbalance.

- A full follow-up is warranted and will be detailed in future publication.

Reviewer 4:

1. No data is provided. No. of patients, curve magnitude, corrections, demography, curve types, nothing has been provided.

- This study is meant as a technique paper and patient selection, while extremely important, has not yet been established. Relative selection criteria used for this study is discussed in line 157

2. Merely saying "more than 1 year is not enough". Please provide definite time interval.

- Discussed in line 50

3. Please define "routine postoperative protocol" as this routine protocol varies all
over the world.

-Commented in lines 133-139

4. Authors used BMP, but they wrote in 2nd paragraph of introduction that BMP is not approved by FDA. please clarify.

- Product is used, with patient consent, as off-label medication. Use of BMP is discussed in line 178-181