Author's response to reviews

**Title:** How Does Scapula Motion Change after Reverse Total Shoulder Arthroplasty?

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**Author's response to reviews:** see over
Dear Editor of BMC Musculoskeletal Disorders

I am willing to submit an Revised article(MS-1029076589650102) about “How Does Scapula Motion Change after Reverse Total Shoulder Arthroplasty?” with the answer for reviewer’s comments as followings.

**BMC Musculoskeletal Disorder-MS-1029076589650102**  
**Comments from the Reviewers:**

**Reviewer #1**

Reviewer: Peter Rundquist  
Reviewers report:  
The effects of RTSA on scapular kinematics is an interesting topic. I have several concerns with your manuscript in its current state.

**Major Compulsory Revisions**  
**Abstract**  
1. Page 3, line 56 – You have not measured muscle fatigue. Preventing periscapular muscle fatigue is likely beyond the scope of your manuscript.  
: The authors agree and were not able to directly measure muscle fatigue, but we propose that increased scapular motion can lead to more muscle fatigue after surgery.

**Methods**  
2. Page 5, line 84 – Why 7 participants?  
: Only recently (i.e., 2007) have Korean shoulder surgeons began to use the reverse shoulder arthroplasty to manage patients with rotator cuff tear arthropathy. This paper is a preliminary report of our early experience with this prosthesis. Based on our inclusion criteria and the fact that it is difficult to have patients return for follow-up, we were only able to include 7 patients at this time. We described this limitation at the last paragraph in Discussion. (referred to at Page 9, Lines 200-201)

3. Page 5, line 85 – Are your participants representative of the RTSR population (age, gender distribution)?  
In our findings, unfortunately, although It is hard to say these only 7 patients being representative of general population for RTSR. However, I believe that the distribution in this group could be not significantly different from general population of RTSR since the demographics includes age 60 years old or older, more highly prevalent in women than men which are generally acceptable in general.

4. Page 5, line 89 – You should define “...pseudoparalysis with cuff tear arthropathy...”  
: We have defined pseudoparalysis in cuff tear arthropathy as less than 90 degrees of active forward elevation without actual neurologic deficit. This is now reflected in the revised manuscript. (Page 5, Lines 93-94).
5. Page 6, line 112 – Has the technique you outlined been used previously? How accurate is it? How
does it compare to other potential techniques (electromagnetic, goniometry, video)?

: Unfortunately, although our finding is based on 2-dimensional image study, not 3-dimensional or
dynamic study, however, it still has clinically meaningful to understand post RTSR changes of angles in
GH or ST joint.

Results
6. Page 6, lines 121-124 – Why are you using these tools? The rationale should be outlined either in the
Background or Methods section. Are the changes in scores of the various tools clinically significant?
What are the psychometrics of the KSS?

: The American Shoulder Elbow Surgeons (ASES) score is typically used and widely accepted clinical
outcomes tool to evaluate pain and activities of daily living after shoulder surgery. The Korean Shoulder
Score (KSS) measures function, pain, patient satisfaction, active range of motion in two planes, strength,
and endurance. It is similar to the Constant-Murley score. The only psychometric in the KSS is the
patient satisfaction score (i.e., 10% of total score). This is now reflected in the revised manuscript. (Page
6, Lines 119-124)

Yes, surgical intervention led to clinically significant increases in both the ASES and KSS scores.

7. Page 6, lines 125-126 – SHR is the ratio between humerus to scapula to scapula to trunk motion. A
higher value indicates a larger humerus not a larger scapula contribution.

: Scapulo-humeral rhythm(SHR) would be defined the ratio of GH: ST, which means high value correlate
with more GH motions. Therefore, In our findings, it means that lower value of SHR might be correlated
to more wide ST motion in post-surgical side comparing to contralateral side.

We have edited the text to better explain our findings. (Page 7, lines 155-157)

Discussion
8. Page 8, lines 159-160 – I believe your interpretation is backward. An increase in SHR would indicate an
increase in the humerus component.

: The authors agree with your opinion, but, we just would like to propose the hypothesis that more
scapular motion after RTSR may cause more muscle stretching & fatigue after surgery.

We have edited the text. Please refer to Page 8, lines 170-172

9. Page 9, line 182 – Yano’s interpretation of SHR is opposite of what you have discussed.

: In my understanding, Yano described that the GH motions contribute more in angles below 60 degrees
in abduction (the setting phase) rather than scapular motions, due to initial periscapular muscle
stabilization. And, ST motions contribute more in angles over 60 degrees in abduction (the later phase)
rather than GH motion.
Therefore, it is appropriate interpretation which the abduction might be operated by GH motionsn
initially due to the stabilization of periscapular muscle and then, scapular itself in later.

10. Page 8, line 167 – As you did not measure muscle activity, it may be inappropriate to discuss
periscapular muscle fatigue.

: The authors agree with your opinion, but, we just would like to propose the hypothesis that more
scapular motion after RTSR may cause more muscle stretching & fatigue after surgery.
Minor Essential Revisions

Abstract
11. Page 2, lines 36-39 – It is unclear whether you are investigating scapular position or motion.
   : Yes, we agree. We have corrected the manuscript to reflect scapular position.

12. Page 2, lines 40 and 54 – You should define the acronym (RTSA) here. Additionally, be consistent with your use of either reverse total shoulder replacement (RTSR) or reverse total shoulder arthroplasty (RTSA).
   : Yes, we agree. The manuscript has been revised to reflect reverse total shoulder arthroplasty (RTSA).

Background
13. Page 4, line 63 – There have been several more recent studies of SHR than Inman’s. Utilizing a more recent citation would be appropriate.
   : We cited the recent reference (published in 2010 in JSES) related to scapular kinematics (Page 4, Lines 67-69).

14. Page 4, lines 71-72 – This statement is essentially your hypothesis. If the amount of biomechanical change is already known, there would be no need for your investigation.
   : This reverse shoulder prosthesis changes the glenoid center of rotation, distalizes the humerus, and elongates the deltoid. However, there is a lack of information on the changes in scapular position after reverse total shoulder arthroplasty.

Methods
15. Page 4, line 83 – For the purposes of this manuscript, the appropriate term would be participants rather than patients.
   : We believe that the word “patients” is better than “participants” because these subjects underwent a surgical procedure after being appropriately informed of the benefits and risks of surgery.

16. Page 4, line 92-107 – This may be more descriptive than necessary. Do the specifics of surgical technique impact the kinematics?
   : Yes, the surgical technique can impact the kinematics. For example, placement of the glenoid baseplate, humeral version, and thickness of the polyethylene insert all can affect the postoperative shoulder joint kinematics.

17. Page 6, line 110 – Why was passive external rotation initially avoided? Results
   : We wanted to avoid excessive stress on the healing subscapularis tendon repair.

18. Page 6, lines 127-143 – Could this information be summarized in a table? Could scapula motion around the other planes (rotation and tipping) affect your results?
   : We agree and have added a table summarizing this information (as Table 1) (Page 15).

   It is possible that it could probably be affected by other planes of scapular motion, described in discussion part as one of limitation in our findings.
Discussion
19. Page 7, line 147 – This is your first mention of the other 2 planes of scapular motion. Are they important?
: We have omitted this first paragraph from the Discussion section

20. Page 9, line 188 – “…not internal, external rotation…” implies they are around different axes.
: We have edited the text. Please refer to Page 9, Lines 201-202

References
21. Check your references. Reference 1 appears to be incomplete. Discretionary Revisions
: We have omitted this incomplete reference.

Background
22. An outline of the progression toward and rationale for performing a RTSR would be a useful addition to your background.
: We have edited the text and it can be found on page 4, Lines 73-74.

Discussion
23. This appears to be a pilot study. Do you have any recommendations on how this research could progress?
: Yes, we agree. This is a proof of concept study. Future work will include more patients and use of CT to measure scapular position.

Level of interest: An article whose findings are important to those with closely related research interests
Quality of written English: Needs some language corrections before being published
Statistical review: No, the manuscript does not need to be seen by a statistician.
Declaration of competing interests:
I declare that I have no competing interests.

Reviewer #2
Reviewer: Xu Xu
Reviewer's report:
This manuscript reports on scapula motion changes after reverse total shoulder arthroplasty. Since scapula motion can contribute to shoulder impingement, the results of this manuscript seems to have good relevance for improving the understanding of rotator cuff injuries. Overall, the paper was not very well presented. There are many errors in English writing which needs to be more corrected (e.g. the word “university” in the cover was spelled wrong).

Page 4 para1 Please provide more details regarding “normal ratio” and “scapulohumeral rhythm”. An illustration would provide a better understanding for these phrases.
: We have added a new figure, demonstrating the “normal ratio” and “scapulohumeral rhythm” (referred to Figure 1 at Page 14, Lines 297-299)
Page 6 para 3 Were those shoulder joint angles consistent with the definition recommended by the International Society of Biomechanics?
: Yes, shoulder joint angles consistent with the definition recommended by the ISB. However, in the orthopaedic literature, it is acceptable to us the terminology forward flexion and scapular abduction.

Page 8 Line 159: What is meant by “greater motion”? (greater ranger, speed, or etc.?)
: We have edited the text to better explain our findings. This is reflected on Page 8, Lines 170 to 172.

Figure 1, 3 and 4 is too small to be readable.
: Yes, we have addressed this issue by increasing the font size.

Comments from the Author:
We corrected many errors in English writing overall.
We added one author (David Kovacevic) who gave substantial contributions to revision of manuscript.

Thanks so much.

Sincerely yours.

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