Author’s response to reviews

Title: Experimentally induced incomplete burst fractures - A novel technique for calf and human specimens

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Author’s response to reviews: see over
Dear Editor,

We are proud to resubmit our paper regarding a novel technique to experimentally inflict incomplete burst fractures in calf and human multi-segmental spine samples to BMC.

We seriously took notice of all reviewers’ comments and revised our draft. Each reviewer’s comment is answered point-by-point:

**Reviewer: Sami Tarsuslugil**

1. Phrasing issue in the conclusion. ‘The presented set up presents’ consider rewording.

Rewording was performed as recommended – changed phrase:

“The presented set up enables the first experimental means to reliably model and study distinct incomplete burst fracture patterns in an in vitro setting”

2. Third paragraph typing error: ‘how to treat this type of injuries’ consider either of the following – ‘These types of injuries’ or ‘This type of injury’.

Changed to “This type of injury”

3. Fourth paragraph: May wish to consider elaborating. How do the clinical studies and Panjabi studies reveal instability of burst fracture? One sentence will do for this I think.

Further clarification was added:

“They observed that injuries to the middle column (according to the 3 column theory from Denis [3]) corresponded best with increased instability.”

4. Fifth paragraph: Try to avoid using the term ‘Hazy’ it is too informal, consider the word ‘ambiguous’ instead.

Changed to “ambiguous”

5. Last paragraph of this section: You talk about burst fracture treatment being controversial but I think this is due to the debate about mechanical and neurological stability of the injury and the conservative vs. invasive treatment debate. Therefore I suggest that you clarify what you mean by elaborating on why the treatment, in this case is considered controversial.

“There is still an incomplete understanding of mechanical and neurological stability of this injury. Consecutive there are no clear commonly accepted treatment algorithms. Treatment options vary from conservative to invasive dorso-ventral treatment. On this account, the lack
of an experimental means to produce appropriate subtypes of burst fractures is a pressing issue.”

The added text should clarify why in our experience there is a controversial in how to treat incomplete burst fractures (conservative – dorsal – minimal invasive – ventral – dorso-ventral, etc.). To our knowledge neither a commonly accepted treatment algorithm, nor a clear recommendation is present.

6. Consider rewording the first line e.g. Ten fresh bovine spines aged between 3–6 months were obtained from the local abattoir (Name and details). Also you don’t mention what vertebral level you are removing the bovine tissue from.

“Ten fresh bovine spines aged between 3- to 6-month were obtained from a local abattoir (Westfleisch, Hamm, Germany).”

Rewording was performed and the abattoir’s name and details and the region where we removed the bovine tissue from were added. Detailed level of each specimen is provided in table 1.

7. First paragraph: It is confusing when you refer to the five-vertebra segments as ‘fragments’ as this is a term that is commonly used to describe the piece of bone that is retropulsed into the neural canal during the burst fracture process. I would prefer you use the term ‘segment’, also I think your use of the term ‘4 FSU’s’ to describe 5 vertebrae is incorrect (it suggests to me that you are talking about 8 vertebrae) or at the least slightly confusing. I do understand what you mean but it is superfluous to use both terms and you’d be better off just describing them as five-vertebra segments.

“All experiments were performed on five-vertebra segments of the thoraco-lumbar junction and lumbar region. The middle vertebra (3rd vertebral body) that was the target vertebral body for fracture creation of each specimen is presented in table 1.”

The term „fragments“ is changed. We changed the text according to your recommendation avoiding the term 4 FSU to describe a five-vertebra segment specimen and the vertebral level in the whole draft.

8. I feel a justification on why you are using five-vertebra segments to create the fractures might be necessary. Just a sentence or two would make it clear to the reader.

“Five-vertebra segments were chosen to establish a model reliable to investigate different biomechanical effects in the treatment of incomplete burst fractures and to facilitate multi-segmental testing on the fractured samples.”

We intend to perform different multi-segmental studies using our model. By planning so, we are not even interested in the fractured level itself, but also in effects of stabilization (bi-segmental, multi-segmental – ventral /dorsal etc.) and even the behavior of the adjacent level. Therefore we designed this five vertebra segment model.

We completely agree, that as the reviewer stated, human tissue is estimable. We also agree, that there is a need to reconsider the need of this multi-segmental model depending on the specific questions of each further experimental trial.
Human spine samples:
9. It might be worthwhile mentioning that burst fractures occur predominantly in the younger population and that ideally young human tissue would be better than older osteoporotic tissue, also, there are large differences between osteoporotic human tissue and young calf tissue so the fact that your technique appears to work on both might be something you want to mention as you could argue that the technique would work on everything in-between.

“Despite the predominantly occurrence of burst fractures in younger population the presented study was performed in osteoporotic spine samples due to the availability of human post mortem tissue.”

The predominantly occurrence of incomplete burst fractures in the young was added. In addition the supposition that the presented method is usable in everything in-between young calf and old osteoporotic human spines is added in the discussion section:

However, the presented technique resulted in incomplete burst fractures in osteoporotic human and young calf spine samples. This suggests that the presented technique might work on everything in-between and differences in bone quality may less influence the induction of similar injuries for biomechanical testing.

Discussion:
10. Calf spine samples: Did you notice any fracture propagation following the growth plates of the young bovine tissue? If so, it is important to mention it.

“The growth plate was involved in all fracture patterns. However, as described above, all osteotomy-like lesions cut through the caudal aspect of the vertebral disc, the endplate, the physis and the cranial aspect of the vertebral body. So fracture propagation following the growth plates resulted in further fragmentation of the produced fracture of the cranial vertebral body.”

The involvement of the growth plate is now mentioned. Also the morphologic influence of the produced fracture is described.

11. Human post-mortem samples: Not all drop mass techniques require repeating the mass impact until fracture is produced, it is important that you do not make this suggestion i.e. ‘Some authors have used a repeating dropping mass technique, a method that requires repeating the mass impact’.

Changed to:

“Some authors have used a repeating dropping mass technique, a method that requires repeating the mass impact [18, 23-25].”

12. Clarify the sentence where you describe a ‘20% vertical compression’. I understand what you mean but it would be better if you made it clearer.

“Shono et al. used a high-speed vertical compression to inflict L1 burst fractures in multisegmental specimens. Therefore, the L1 vertebra and adjacent discs have been isolated
by upper and lower box-shaped fixtures. Compression was performed under displacement control in a compressive direction until the distance between the upper and lower fixture was reduced to 10% of the original height in 0.5 seconds [11]. The axial compression of 20% of the original height of the target vertebra necessary in our protocol may have been due to a possible difference of rigidity of the used temporary fixation of the adjacent vertebrae.”

The changed text should clarify some possible differences between Shono’s paper and the presented method.

Reviewer: Gereon Schiffer

1.) Background
This section of the paper describes the basic problem appropriately and points out the relevant literature properly. I would recommend to add a schematic drawing of the Magerl-Classification (A3.1-A3.3).

A schematic drawing is added (fig. 1)

To increase traceability representative axial and sagittal slices from the CT scans of each of the eight human fractures should be added.

A presentation of representative axial and sagittal CT slices of all 7 specimens is added instead of a representative figure of one sample (fig. 5).

We hope that the revised manuscript meets the reviewers’ suggestions; the expectations of the editorial board and that you consider publication of our work at BMC.

Should there be any open issues regarding the draft, please do not hesitate to contact me.

Yours sincerely,

René Hartensuer, MD