Author’s response to reviews

Title: Compression and contact area of anterior strut grafts in the instrumented spine: a biomechanical study

Authors:

Antonius Pizanis (antonius.pizanis@uks.eu)
Jörg H. Holstein (joerg.holstein@uks.eu)
Felix Vossen (felix.vossen@gmail.com)
Markus Burkhardt (markus.burkhardt@uks.eu)
Tim Pohlemann (tim.pohlemann@uks.eu)

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Author’s response to reviews: see over
To
Mr. Reynaldo Aldea Jr.
on behalf of Prof Alison H McGregor

BMC Musculoskeletal Disorders

May 19th, 2013

Manuscript submission, Pizanis et al.
BMC Musculoskeletal Disorders MS: 5087395579335189
Research article:
“Compression and contact area of anterior strut grafts in spinal instrumentation: a biomechanical study”

Dear Mr. Aldea,

please find enclosed our revised manuscript which we would like to submit for publication as an original article in BMC Musculoskeletal Disorders.

We have appreciated the fair, constructive comments and remarks of the reviewers and the editor. We have revised the manuscript according to the suggestions. All changes made in the revised manuscript are marked in yellow. Please find also enclosed our point-by-point reply, which addresses all comments and questions.

We think that the quality of the manuscript has markedly improved due to the changes and additions made according to the suggestions of the reviewers. We therefore hope that the manuscript will now meet the criteria for publication in BMC Musculoskeletal Disorders.

Sincerely yours,

Antonius Pizanis, MD
Corresponding author

Trauma-, Hand- and Reconstructive Surgery
University Hospital of the Saarland
Kirrbergerstr. 1, 66421 Homburg/Saar, Germany
e-mail: antonius.pizanis@uks.eu
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Original article:
Compression and contact area of the anterior strut grafts in spinal instrumentation: A biomechanical study.

Authors:
Antonius Pizanis  (antonius.pizanis@uks.eu)
Jörg H. Holstein  (joerg.holstein@uks.eu)
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Markus Burkhardt  (markus.burkhardt@uks.eu)
Tim Pohlemann  (tim.pohlemann@uks.eu)

Reply to the comments of the Editor and the reviewers:
We appreciated the fair and constructive comments. Please find in the following our point-by-point reply.
Necessary changes or corrections to the manuscript were highlighted:
Please note, that following the reviewer’s suggestion, we corrected the choice of words in the title.
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Original article MS: 5087395579335189: Compression and contact area of the anterior strut grafts in spinal instrumentation: a biomechanical study.
by A. Pizanis et al.

Thank you for consideration of our manuscript for publication in your journal.
We have reviewed the above manuscript according to the reviewer`s comments.

Editorial Requirements:

1.) Please describe the source of the calf spine used in your study.

*We added the source in line 86, p 5- Methods section.*

Reviewer #1: Parshia Moghadas
Reviewer`s report:
The reviewer would like to thank the authors for the very interesting study they performed. There are few comments the authors are asked to revise.

Minor Essential Revisions:

Comment #1:
Line 6, Abstract: in the Background section, the aim of the study is not clearly defined. The authors are asked to either add a sentence to specify the aim(s) of the study, or to expand the final sentence to reflect the aim(s) clearer.

*We expanded the last sentence of the Background section.*

Comment #2:
Figure 3 caption: it is not clear what “Significant changes: # vs. baseline “pressfit” situation: P < 0.05; * vs. group A-Type P < 0.001” represents in the figure. For example, what does “* vs. group A-Type” mean? Does it mean that the columns with a * sign are in fact the results versus that for group A-type or does it have a different meaning? Please revise, either by re-writing the figure caption or briefly explaining it in the main text.

*We corrected the legend to the figure 3 (line 437 ff., p 18) and table 1 to allow a better understanding.*

Also, is there any particular reason why one of the hash signs on the graph is gray?

Similar comments also apply to Table caption.

*We corrected the hash signs in graph 3. Initially, it was meant to underline the purely experimental character of testing an anterior rod fixation for a type C injury of the spine, but we fully agree that the grey shading is misleading. The remark for clinical application is sufficient in the legend.*

Comment #3:
How was the mean contact force calculated? Was it based on the final reading or a series of readings at any one time? The authors are
encouraged to specify the cycle time during which the contact force was measured.

- At each phase of the instrumentation for the experiments, the sensor readings were recorded for 3 seconds. The I-Scan software allowed the evaluation afterwards. Tekscan describes in the technical manual the scanning of the sensors at 100 Hz. The software displays the averaged sensor values. We specified these information in the “Methods” section (line 119 ff., p 6).

Comment #4:
Figure 4 neither matches the caption nor the material it has been referred to in the main text. Please make the necessary changes. Also, there is an additional figure (Figure 5) at the end of the manuscript, which has not been referred to in the text. It does not have a figure caption either, so it may have been uploaded by mistake. The authors are asked to make the necessary amendments.

- We apologize for the mistake. Figure 5 is corrected to Fig 4b in the current upload.

Comment #5:
Typo errors:
Line 127, Methods section: anterior should start with capital A, to match the rest of the list
Line 165, Results section, final paragraph: “group C-Type C”– Please remove one of the “C”s.
Line 198, Discussion: “group C-Type group”– Please remove one of the “group”s.
Line 264, Conclusions: please correct the sentence “can help surgeons to in their choice of”

- All errors were corrected as indicated by the reviewer.

Reviewer #2: Andrew T.M. Philipps
Reviewers report:
The paper presents the results of the level of compression achieved when press-fitting wooden blocks into a bovine spine, drawing conclusions as to how bone grafts may be expected to perform in the human spine for two different fracture scenarios; one where the ligaments remain intact and one where they do not.

The paper is in general well written although I have some major concerns outlined below, along with some minor amendments that should be made.

The main concern is that the level of compressive force achieved on the wooden block appears to be entirely dependent on how the fixation device or devices are applied. There does not seem to be any testing beyond the application of the fixation devices so it is difficult to see whether the results can be extrapolated to the human scenario where the spine is loaded axially and in bending. To draw conclusions it would seem reasonable to expect some form of testing covering the range of loading that is likely to be experienced in-vivo. As this is not done it is not clear if the results can be applied beyond the study.

- The compressive force on the graft substitute is significantly reduced when posterior fixation devices are used in the type of injury affecting the ligaments in addition to the fracture (group “Type-C”). The results presented here from static, unloaded
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experiments represent the base of our research on graft-vertebral body interactions and reflect the feasibility of this method used for the first time in that interface. The reviewer is absolutely right to urge for further investigation under physiologic conditions. Actually, we have completed and evaluated a series of cyclic loading trials under various conditions to elucidate the long-term effect of compression and contact on the bone grafts in the injured spine. Of course, the amount of these interesting supplemental results is not suited for one single paper.

Inspired by other studies concerning the basic techniques of mounting the fixation devices on unloaded specimen (Ref. no. 30 Krodel et al in Spine, no. 32 Bolger et al in Eur Spine), we believe that our findings discussed in this article are of practical interest, too. An important goal in the operation is to compress the graft and allow a maximum of bone contact using the stabilising fixation implants. Our results focus on this first step of treatment. It is also worth mentioning, that the patient’s spine in real life circumstances is unloaded for about at least one third of the day (sleep) and without explicit movement during rest (lower activities after surgery). It is beneficial to provide adequate compression of grafts during these periods, also.

We fully agree with the reviewer, that the results of a bench-top study are not necessarily applicable to the clinical reality. For this reason, we supplemented this limitation in the text (p11, line 259).

Throughout the paper the authors refer to ' instrumentation' when it is clear that the 'fixation devices' are not instrumented so this term is inappropriate and should be avoided. This is also the case in the title.

- This seems to be confusing vocabulary. In surgical/medical terms, “spinal instrumentation” means implants or fixation devices have been applied on the spine. It can be understood as synonym to implant or hardware. With this common intent, the terms are used in PubMed-listed titles (308 times) or included in titles or abstracts (1011 times). Similarly, we intended to describe spines, on which implants were mounted as “instrumented spines”. It should not be misunderstood as spines (or fixating devices), in which sensors or technical instruments were inserted for experimental measuring purposes.

To avoid any confusion, we corrected text passages with the term “instrumented spine”, mostly using “stabilised spine” instead. For the title, we chose the term “spinal instrumentation” instead “instrumented spine”.

While the authors focus on achieving compression in the axial direction it would be useful to comment on other factors for incorporation of bone graft that are not addressed in the study. The distribution of pressure across the film could also be commented on further.

- We kindly refer to the discussion part lines 241 ff. concerning other factors for bone graft incorporation. A comment about the distribution of the pressure across the film was added in the text (p 9, line 197).

In the methods section diagrams or photographs of the various fixation devices would help considerably. It is not enough to provide brand names and expect the reader to be familiar with these.

- Following the reviewers suggestion, we added the information to the legend of fig. 2, depicting the posterior fixation device called internal fixator (“USS, Synthes”) and the anterior fixation mentioned as anterior rod (“Ventröfix, Synthes”).
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The wooden blocks are described as 'dowels' which suggests a cylindrical shape. The description should be changed to 'blocks'.

- We thank the reviewer for this remark. We were misled from the clinical term used for iliac crest bone grafts, which are called strut grafts, probably because of their naturally rounded edges. In our revised article we corrected all struts to blocks following the suggestion. However, the term strut was kept when the clinical relation persisted.

In the results section there is a large amount of discussion when the table and figure could simply be presented and the discussion included in the discussion section of the manuscript.

- We confined our text in the results section to less than 30 lines, purely describing the results or commenting graph 3 and table 1. The discussion of the results was left for the Discussion section lines 180 ff..

The discussion should include more on the limitations of the experimental approach. It is not enough to provide a single reference to indicate that the findings from an unloaded bovine ex-vivo model will be applicable to a loaded human in-vivo scenario.

- Corrected (p11, line 259)

Figure 5 has been incorrectly labelled.

- We apologize for the mistake. Figure 5 is corrected to Fig 4b in the current upload.