Reviewer’s report

Title: Subcutaneous internal anterior pelvic ring fixation versus external pelvic ring fixation - a biomechanical study

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Reviewer: Pol Maria Rommens

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Major Compulsory Revisions

1. List of authors: there are 9 authors listed here. According to the paragraph “authors’ contributions”, of these, only 2 authors participated in all stages of the present study from planning of the study, biomechanical testing, data analysis and drafting the manuscript. Another author, the last author, participated in all stages except for data analysis. Therefore, he may contribute, unwittingly or not, to publishing data that has not been profoundly reviewed and thoroughly tested in his sense/meeting his requirements. Some of the authors involved in testing were not involved in data analysis and vice versa. Two authors only contributed in either drafting/revising the final manuscript. One author only involved himself in data analysis. The contribution of these 3 latter authors may be considered to be simply acknowledged. It remains unclear for this reviewer if participating in only one step of the scientific process from idea to publication adequately meets the requirements of the journal “BMC Musculoskeletal Disorders” and justifies an authorship of a manuscript assigned to be published by this journal.

2. Abstract: the authors describe some possible disadvantages and a potential complication of external fixation of pelvic ring fractures as a primary treatment of pelvic ring fractures to justify their evaluation of subcutaneous internal anterior fixation (SIAF) system presented in the portrayed manuscript; thereby suggesting that neither of the named disadvantages applies to SIAF. The authors then describe that each system was linked to a standard testing machine using polyoxymethylene (POM) as an interface. This material is known for its high strength, hardness and rigidity; all of which do not regularly represent the condition of human bone - and does not apply to osteoporotic bone at all - although one may presume that in POM there will be adequate purchase for all kind of screws that may be eventually used by the authors. Although the authors describe each specimen to be tested to a total of 2000 consecutive cycles with alternate loading every 200 cycles, they only describe results after 100, 300, 500, 700, and 900 cycles respectively. This reviewer is unsure of the effect of the remaining 1100 cycles. Moreover it remains unclear to this reviewer, why precisely the described numbers were chosen. The lateral compression/distraction of +/- 50 N appears somewhat low to represent loads acting upon a patient’s pelvis after external fixation. Other directions/motion than lateral compression/distraction and torque (+/- 0.5 Nm) do not seem to been taken into account by the authors or were not addressed in the study design. For translational stiffness, there was no statistical significant effect between the 2
tested devices. For rotational stiffness, there were only significant differences after 300, 500 and 900 cycles described. The authors conclude from their data that SIAF is as stable as external fixation to translational forces and more stable in rotation. However, there is only a significantly higher rotational stability as tested by the authors at some of the cycles. The reviewer does not agree with the authors that one can conclude a higher rotational stability of one device compared to the other from the presented data. Although “subcutaneous internal anterior pelvic ring fixation versus external pelvic ring fixation” were suggested to be evaluated in “a biomechanical study”, the present study merely represents a description of pure mechanical testing of 2 different fixation devices that can also be used for pelvic ring surgery. There is neither internal fixation, nor anterior pelvic ring fixation not external fixation nor external pelvic ring fixation, nor pelvic bone subjected to any testing in this study; and none of the described testing is biomechanical. Thus, the title of the present manuscript may be considered as inappropriate. I would suggest entitling this manuscript such as “mechanical testing of 2 different devices” that may be either used for internal or external fixation of pelvic ring fractures. The authors believe their study to represents a “basic science study” of which this reviewer reckons it is not. The keywords/-phrases “pelvic fracture” and “pelvic ring injury” are not exactly covered by the content of the here reviewed manuscript.

3. Background: Line 45: “primary treatment”. Do they mean “emergency treatment”? Line 45: “commonly accepted”. So why do they write it down here? Line 56: “external fixation has been the only possibility...”. Really? I don’t think so. Line 61: “multiple second looks and revisions” may be replaced by “multiple revisions” or “patients require revision surgery”. Line 63: Surgery is as good as always more difficult in obese patients. Why do the authors think that internal fixation is easier to perform in obese patients? Line 66: The authors do not mention the rationale for mounting the SIAF in a different fashion as described by Kuttner et al.. Line 72: Do the authors consider SIAF as definitive surgery. In which kind of pelvic ring lesions? Is there additional stabilization of the posterior pelvic ring required? Line 73: “in vitro” / “in vitro”. Line 73: The purpose of this study appears to be not adequately addressed by the testing samples and the study design.

4. Methods: Line 79. Reference [14] represents a biomechanical study that assesses Ventrofix vs. MACS vs. SpiralBlade. It remains unclear to this reviewer why this study is mentioned here. Line 81: “restraint” shall be replaced by “purchase” as this is what the authors mean. Line 88: “maximum effort by the same person”. What exactly does that mean? Was a torque-limiter used? The force applied on the specimen must be measured and (later mentioned). In contrast, in the SIAF-group several persons seem to be involved in placing the pins. Is that correct? Torque-limiter? Line 100: “rolling the patient side-to-side is common [...] result in lateral compression forces”. That is true. However, it is also simplified as rotational stress is not considered. Line 106 ff.: Please explain the rationale for using >25mm +/- 50 N. Line 125: where are these expectations are coming from? Line 130: possibly, the data presented here does not follow a Gaussian distribution. In that case, a Student’s t-test cannot be used for statistical testing. If the authors have tested for normal distribution, they should
5. Results: This section appears very short. The findings shall be discussed more detailed in the respective section of the manuscript. For example, it would be of interest for the reader, how the authors interpret their finding that “the level of significance was not achieved” at 700 but at 500 and then again after 900 cycles when testing for “rotational stiffness”.

6. Discussion: “Several case series using a pubcutaneous internal anterior fixation showed good short-term results”… and high complication rates. Line 166: How can your “in vitro” data be consistent with findings of a clinical study? Please explain in more detail or omit this sentence.

7. Conclusions: There is no “pelvic ring instability” that has been treated by the authors using neither an external fixateur nor an internal anterior fixation device. Line 209: “in vitro” as a loan word from the Latin language may better be spelled in italics. Line 209: “superior” may be replaced by “significantly more stable in some cycles when tested to rotational stability”. This reviewer is not sure whether this conclusion is valid based upon the data described in the present manuscript. The authors speculate that the device they have tested and that may also be used for “subcutaneous internal anterior fixation (SIAF) of pelvic ring instabilities” may be “a useful tool in the treatment of pelvic ring injuries”. This is all speculation and has nothing to do with the mechanical study as described by the present manuscript. It remains unconceivable for this reviewer how a technique that in another part of the present manuscript is described by the authors as potentially more difficult – and hence more time consuming – to implant in a patient and also eventually burdened by more serious side effects, should contribute to a safer and more efficient surgery in the emergency setting in an unstable patient.

8. References: the style presented by the authors in the present manuscript does not fulfill the formatting/style as required and as published by the journal “BMC Musculoskeletal Disorders”.

9. Figures legends: may be considered for publication as they are, although they are vastly short. The description of the dimensional sketch depicted on the left is missing in this legend as is the purpose of this dimensional sketch.

10. Figure 1: it can hardly be recognized that this is figure 1. The prospective are changed from each device mounted on a synbone model compared to the respective device being screwed to 2 POM-blocks. It may be unclear to the reader whether the respective angle of screw/pin placement is the same for this model; whether the pelvic bone models are of the same size (and gender); further the mode of screw/pin placement may eventually differ from the description in the text. Figure 4: there are “*” and connecting bars, both indicating significance of a subgroup tested, missing in this figure.

**Level of interest:** An article of importance in its field

**Quality of written English:** Needs some language corrections before being published.
Statistical review: Yes, and I have assessed the statistics in my report.

Declaration of competing interests:
I declare that I have no competing interests