Author's response to reviews

Title: Reinforcing the role of the conventional C-arm - A novel method for simplified distal interlocking

Authors:

Markus Windolf (markus.windolf@aofoundation.org)
Josh Schroeder (josh.schroeder@aofoundation.org)
Ladina Fliri (ladina.fliri@aofoundation.org)
Benno Dicht (benno.dicht@aofoundation.org)
Meir Liebergall (liebergall@hadassah.org.il)
Geoff Richards (geoff.richards@aofoundation.org)

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Author's response to reviews: see over
Dear Sir,

hereby we would like to submit the revised manuscript “Reinforcing the role of the conventional C-arm - A novel method for simplified distal interlocking” according to the comments of the reviewers. Please find attached the point-by-point answers below.

We hope that our work will be considered for publication.

With kind regards

Markus Windolf
Response to the reviewers

Reviewer: Mustafa Citak

Reviewer's report:
I have reviewed the article entitled “Reinforcing the role of the conventional C-arm - A novel method for simplified distal interlocking”. The authors describe a newly developed guided freehand technique for distal interlocking. The primary outcome parameters are the radiation exposure and surgery time as well as the number of X-rays between both groups. The authors found that the newly developed guided freehand technique for distal interlocking has proven to markedly reduce radiation exposure when compared to the conventional freehand technique. Furthermore, this method does not require cost intensive add-on devices or extensive training. In general, the study character and the description of the manuscript are adequately done and interesting. I would prefer to accept this manuscript after minor revisions.

Title: appropriate

Abstract: Appropriate. Please change in line 7 “OR-like” to operating room (OR) like

done

Keywords: Please add at least 3 Keywords

The following key-words were added to the manuscript: distal interlocking, distal targeting, nailing, free-hand locking, computer aided surgery

Introduction: The introduction part is well written. However, in my opinion it is too long. Line 57-68 is redundant.

We agree. The mentioned sentence was removed.

Materials and Methods:
In general, the M&M part is also well described. The supplementary files are very helpful.

Results: Well done

Thank you.

Discussion: Well written and discussed. The discussion part is also too long. Please start with the general findings of the study and just focus on your most important finding and correlating pre-existing studies and thoughts. Remove all unnecessary parts and suggestions.

The discussion was shortened by approximately a quarter according to your suggestions.
Reviewer: Peter Rhee

Reviewer's report:

Minor Essential Revisions
1. Page 4, line 57 (paragraph 1): What is the average radiation exposure per C-arm for the distal tibia tissues and is there any published data on the amount of radiation exposure.

   Thank you for the question. Available literature about radiation exposure in nailing is discussed in lines 184 – 199 in detail.

2. Page 4, line 75 (paragraph 4): Does this "arbitrary" image still need an adequate axis through the interlocking hole (in other words, does this require more than a single image if the hole is off in rotation or tilt from the C-arm beam?)

   A sentence was added to clarify that the hole can be oriented oblique to the X-ray beam. This is the advantage of the method.

3. Page 6, line 80 (paragraph 1): Have any pilot studies been performed to assess the accuracy of this technique/software with a degree of error.

   No particular study on accuracy was performed because it mostly depends on how precisely the surgeon matches the guiding device with the guiding circles. This study actually intends to investigate the accuracy of the overall procedure with the criteria whether the locking hole was met or not.

4. Page 6, line 92 (paragraph 2): Although a skin incision is proposed, this is not projected on the patient. Therefore, is the skin incision determined with a radio-opaque object (scalpel, clamp, etc) and image acquisition?

   Thank you for this question. In lines 98-99 it was clarified that the incision was performed with a scalpel under fluoroscopic control.

5. Page 6, line 98 (paragraph 3): Is this not similar to freehand other than the exception of using an additional external guide (two radio-opaque rings)?

   The advantage of the method lies in the fact that the hole does not need to appear round on the X-ray. No pivoting of the C-arm is required anymore. It can remain at its initial position. This was clarified in lines 77-79.

6. Page 9, line 155 (paragraph 1): What was the definition of a "misplaced" screw? Mal-alignment or missing the hole completely?

   Missing it completely. The sentence was rephrased to clarify this issue.

7. Page 9, line 155 (paragraph 1): How about the accuracy of the screw engaging the correct far cortex? Can the screw be placed through the drill guide?

   Thank you for the comment. Since the drill-guide is hand-held, screw guidance would require further radiation to find back the correct alignment. Therefore the screw is inserted without guidance which in some cases could lead to mal-
placement even if the hole was drilled correctly. This aspect was added to the discussion in lines 261-262.