Author's response to reviews

Title: A Simplified Guide Ruler for Rotational Osteotomy

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Author's response to reviews: see over
Reviewer #1

Thanks for reviewing our manuscript and valuable suggestion.

1. line 97: Authors should describe the appropriate fixation methods to prevent correction loss and over-correction.

Answer:
It depends on different strategies. With least curve change across bone strategy, we suggest plate to fix the osteotomized bone. With rotation center strategy, we suggest intra-medullary nail or locking plate to fix the osteotomized bone.

Text change:
(In Discussion section, paragraph 3, lines 146 to 152)

   The ideal condition of the osteotomy procedure is the femur with a circular geometry. Equations 1 and 2 show good precision when the cross-section of the bone ends is circular. However, the long bone is usually not circular and somewhat elliptical. For such bones with non-circular ends, the precision for such a correction osteotomy might be influenced by the location of the fixation region. It depends on fixation strategy. If the surgeon tries to fix the osteotomized bone at site with least curve change across bones, the chord distance would be smaller that is accompanied by a larger regional curvature, i.e., small regional radius (Figs. 5, 6). In such strategy, the surgeon should choose plate to fix the osteotomized bone. Because the curvature is different around each segment of ellipses, the chord distance is also different. If the surgeon tries to fix the osteotomized bone by the reference using the rotation center, the chord distance (t) is proportional to the distance to the center (Figs. 7, 8). In such strategy, the alignment is better than the previous one, and the surgeon should choose intra-medullary nail or locking plate to fix the osteotomized bone. These are sources of errors. Therefore for the real practice, we recommend the use of a pair of compasses to measure the determined chord distance. In our computer model, with center rotation strategy, most of the errors are between 2% to -15%. The error is acceptable in such operation.

2. line 111: Readers would like to know further information about electrical version.

Answer:
We will provide electronic version of our protractor freely. It will be uploaded to BMC.
3. line 145: Authors need comment about rotation center.

Answer:
Rotation center means to rotate at the center of gravity. We also build our computer model this way.

Text change:
(In Discussion section, paragraph 3, lines 150 to 152)

The ideal condition of the osteotomy procedure is the femur with a circular geometry. Equations 1 and 2 show good precision when the cross-section of the bone ends is circular. However, the long bone is usually not circular and somewhat elliptical. For such bones with non-circular ends, the precision for such a correction osteotomy might be influenced by the location of the fixation region. It depends on fixation strategy. If the surgeon tries to fix the osteotomized bone at site with least curve change across bones, the chord distance would be smaller than that is accompanied by a larger regional curvature, i.e., small regional radius (Figs. 5, 6). In such strategy, the surgeon should choose plate to fix the osteotomized bone. Because the curvature is different around each segment of ellipses, the chord distance is also different. If the surgeon tries to fix the osteotomized bone by the reference using the rotation center, the chord distance (t) is proportional to the distance to the center (Figs. 7, 8). In such strategy, the alignment is better than the previous one, and the surgeon should choose intra-medullary nail or locking plate to fix the osteotomized bone. These are sources of errors. Therefore for the real practice, we recommend the use of a pair of compasses to measure the determined chord distance. In our computer model, with center rotation strategy, most of the errors are between 2% to -15%. The error is acceptable in such operation.
Reviewer #2

1. This is a very good article written about the rotational osteotomy. From mathematical point of view your idea is simple and correct. Cobeijic et al. reported the operation of 17 patients (21 femures). They followed the patients more than 11 years. And clinical results were satisfactory. This operation is quite rare surgery for us. Therefore, you should give the proof to identify the new osteotomy guide is correct or not using the computer bone model. You article is not interesting for the readers without this proof.

Answer:
Thanks for reviewing our manuscript and valuable suggestion. The computer model is difficult for us, however we finish it in time. The model does approve the precision of Čobeljić et al. Our protractor is also approved.

Text change:
(In Methods section, paragraph 3, lines 78 to 83)  
The error of this method is due to mis-prediction of rotation radius, thus we build a computer model. We first get femur cross-section geometry data from CT (computer tomography) of pelvis below intertrochanter region. Then calculate the radius by method of Čobeljić et al., and then the actual distance from center of gravity to boundary. The differences are the cause of error. Then we calculate the error in percentage of these slices of CT (Fig. 1).

(In Results section, paragraph 2, lines 102 to 106)  
To justify our protractor, we first verify Čobeljić et al. method by computer model (Fig. 1). Totally eight CT slices, 1558 boundary points are collected. The error, which is estimated by calculating difference between real distance from center of gravity to boundary and the estimated radius, the error is between -37 % to 16% (mean ± SD =-6% ± 9%). We think it is acceptable for these operations.

(In Discussion section, paragraph 3, lines 154 to 156)  
The ideal condition of the osteotomy procedure is the femur with a circular geometry. Equations 1 and 2 show good precision when the cross-section of the bone ends is circular. However, the long bone is usually not circular and somewhat elliptical. For such bones with non-circular ends, the precision for such a correction osteotomy might be influenced by the location of the fixation region. It depends on fixation strategy. If the surgeon tries to fix the osteotomized bone at site with least
curve change across bones, the chord distance would be smaller than that is accompanied by a larger regional curvature, i.e., small regional radius (Figs. 5, 6). In such strategy, the surgeon should choose plate to fix the osteotomized bone. Because the curvature is different around each segment of ellipses, the chord distance is also different. If the surgeon tries to fix the osteotomized bone by the reference using the rotation center, the chord distance \((t)\) is proportional to the distance to the center (Figs. 7, 8). In such strategy, the alignment is better than the previous one, and the surgeon should choose intra-medullary nail or locking plate to fix the osteotomized bone. These are sources of errors. Therefore for the real practice, we recommend the use of a pair of compasses to measure the determined chord distance. In our computer model, with center rotation strategy, most of the errors are between 2% to -15%. The error is acceptable in such operation.