Author’s response to reviews

Title: Proximal Radius Fracture Morphology Following Axial Force Impact: A Biomechanical Evaluation of Fracture Patterns

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Author’s response to reviews:

The authors should finalize their manuscript. Some markups were not finalized.

Author’s response: Dear reviewer, we appreciate your time and effort to improve our manuscript. In the following we tried to answer and implement all your suggestions.

Introduction

Well presented. Please describe in more details the two theories for the fracture pattern, i.e. bone density and position of the forearm with literature examples.

Author’s response: Thank you for your comment, we extended the theories for fracture patterns with literature examples. Please see lines 85-89.

Line 95. Problem that all were males.

Author’s response: Thank you for your comment. This circumstance is added to the discussion section as one of the study’s limitations. However, male specimens are overall preferred for biomechanical studies due to high variations in bone density in female specimens. Please see lines 199-201.
Line 97. Even though soft tissues may be necessary to be removed the muscle action and load are important for the mechanism of injury and load transmitted via the radial head.

Author’s response: Thank you for this critical remark. We agree, that muscle action and load are an important factor that contribute to the predisposition of radial head fractures especially at the anterolateral quadrant. However, this study’s purpose was to show that even without the influences of ligaments and muscle action the anterolateral quadrant is still predisposed to fracture, supporting the hypothesis, that geometry and bone density of the radial head and neck may be decisive concerning fracture pattern. As suggested by Amis et al., a biomechanical study with isolated axial forces was needed to better understand the longitudinal fracture lines which are seen clinically. (Lines 178-185)

Line 107-109. The force transmission via the spherical head from a hip prosthesis is entirely non-anatomic and cannot correspond to any clinically relevant scenario.

Author’s response: Thank you for your comment. We agree, that the replacement of the humeral capitulum by a spherical head from a hip prothesis is not entirely anatomic. However, we tried to avoid irregularities in fracture patterns due to bipolar fractures (humeral and radial side). Therefore, we made the decision to replace the capitulum by the spherical head which has the same curvature and diameter according to the radiocapitellar ratio published by Sandman et al.. That said, we believe the readership of BMC will take note of this limitation and interpret the study findings carefully. We underlined this limitation in the discussion section (lines 198-199)

Line 109-110. How was this ensured? Provide details

Author’s response: Thank you for the hint to correct the missing part. The positioning of the radial shaft in the right angle position to the floor was ensured during the embedding with the help of a water bubble. (Lines 116-118)

Line 111. the rate of compressive loading is extremely low and does not correspond to a trauma scenario.

Author’s response: Thank you for your comment. We agree with the reviewer, that the compressive loading was below a trauma scenario. However, to observe and report the fracture origin the given compressive load was chosen. In a pilot series with increased mm/min loading, we didn’t observe any change in fracture pattern compared to the final study findings.

Line 120. Perform and present a proper power analysis

Author’s response: Thank you for comment. We determined the required sample size according to a previous study by the Graham King group, who also investigated the mechanical properties of the radial head with similar outcome parameters. They estimated the required sample size to
be between 10 to 16 specimens and finally selected the average, 13 specimens. We were feasible to test 18 radii which is above the calculated power by the King group and therefore, we believe sufficient. The statistical analysis section is extended accordingly (Lines 127-130)

Results Ok

Author’s response: Thank you for your comment.

Discussion

Try to explain your findings and discuss the literature and limitations more Line 168-172. You did not test rotational forces and you did not test bone d

Author’s response: Thank you for your comment to the discussion part. We filled in a biomechanical study about in-vitro impact fracture tests from 1995 to explain the reasons why we made isolated tests with the radial head without any soft tissue.

Rotational forces were not part of our hypothesis. This study aimed to investigate fracture patterns in isolated axial force impact and compare to previous observations (clinically and biomechanically).

(Lines 178-185)