



Reply to the editorial titled “The role of smartphone technology in trauma spine surgery”

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We were delighted to note the great interest in our article “Reliability of smartphone-based teleradiology for evaluating thoracolumbar spine fractures” (1). The editorial by Dr. Pizones provides a comprehensive view of the difficulty in spinal fracture radiological assessment, and the amount of research required to validate the rather common practice of teleradiological decision making.

We wish to reply to some of the issues brought up with our paper in the editorial as follows:

- (I) Calculation of neural canal penetration, loss of vertebral height and degrees of segmental kyphosis is indeed not simple to perform on a desktop computer, and is naturally much harder when using a smartphone with no length or angle measurement tools available. However, in our study we only required the assessing physician to assign the case to one of several categories—i.e., neural canal penetration between under 25%, between 25% and 50%, or above 50%, and kyphosis under 30% or above 30%. This assignment is possible based on “naked eye” estimation, however as noted, it is not as accurate as tool based measurement, especially for angular measurements. The transfer of a continuous video file as opposed to static images does allow assessment of canal penetration and height loss, even when it is asymmetrical between different parts of the fractured vertebra.
- (II) The value quoted by Pizones regarding near perfect ($k=0.94$) intraobserver agreement over AO classification is incorrectly quoted. This was the value of fracture level diagnosis (i.e., fracture of vertebra D1–L5), which is easier to assess than

the fracture classification. The correct value for intraobserver agreement for AO classification was kappa 0.75. As pointed in the multiples studies in the editorial conducted by Pizones, interobserver and intraobserver agreement when analyzing fracture patterns according to the AO and Denis classifications is imperfect. Additionally, lower kappa values were noted among residents, and non-spine surgeon radiologists. Our study limited the fracture classification assessment to a group of senior orthopedic surgeons, all of whom regularly operated on spinal trauma injuries. The surgeons also had previous experience with the technique of fracture assessment on a smartphone, based on their day to day practice as on call spine surgeons. This may serve to explain the relatively high kappa values indicating substantial, rather than moderate agreement on the AO and Denis classification in our study. We also note that the AO classification selection was limited to the broad types (A, B, C) and did not include the fracture subtype, which also simplified the decision-making process and presumably allowed for a higher kappa value.

- (III) Several studies do indeed show that radiographic fracture assessment does not correlate perfectly with PLC injury as shown on MRI (2). However, a recent worldwide study (3) did not find MRI to be significantly necessary for fracture pattern classification or need for surgery. Even so, awareness of this issue while observing a CT scan over a smartphone would allow the surgeon to order an MRI when the stability of the posterior

spinal elements is otherwise hard to assess.

- (IV) Continued research of imaging analysis over smartphone technology will allow us to acknowledge the benefits and disadvantages of this method and modify our assessments accordingly.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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