Livermore AT, Sansone JM, Machurick M, Whiting P, Hetzel SB, Noonan KJ. J Child Orthop. 2021;15:546–553.

We read with interest the above publication by Livermore and colleagues. Skaggs et al. introduced the technique of lateral K-wire fixation, recommending the use of two or three 1.6 mm or 2 mm K-wires, depending on the age and size of the child (not specified), using an anterior-to-posterior wire entry in the sagittal plane as the capitellum is anterior to the center of the humerus, with maximum wire spread in the coronal plane. Intra-operative stress testing was performed to assess the stability of the fixation, with instability being an absolute indication for the insertion of a third lateral wire.

Gottschalk et al. reported that the best torsional resistances for lateral-entry wire fixations were found with capitellar starting wires along with increased wire diameter (1.6 mm for ≤20 kg, 2 mm for >20 kg patient weight). The British Orthopaedic Association Standards for Trauma (BOAST) recommends the use of 2 mm K-wires for all supracondylar humerus fractures (https://www.boa.ac.uk/resources/boast-11-pdf.html). Pennock et al. identified that reduced wire spread in the coronal plane is associated with increased loss of reduction, with those fractures that lost reduction having had a mean spread of 28% compared to 37% for those that did not lose reduction and recommended a spread of at least 13 mm or 1/3 of the humeral width at the level of the fracture. Livermore et al. did neither consider wire size, the number of wires used, and wire entry point and direction in the sagittal plane, nor if intra-operative stress testing was performed. The only shown radiograph with fixation in place shows two 1.1 mm wires (extrapolated from the given measurement) with a low Baumann angle (BA) of about 60°. The choice of a wire size which is too small indicates that the surgeon was not familiar with the technical recommendations for lateral-entry wire fixation, creating an unstable construct.

Livermore et al. identified that 12 of 24 malunited fractures were inadequately reduced during surgery and that all 9 post-operatively malrotated lateral pin fixations had an inadequate mean pin spread of 9.3 mm, which means that at least 21 (87.5%) malunions were the result of inadequate surgical technique, which would also explain the discrepancy between the high rotational malunion rate of 20.9% for lateral K-wire fixations compared to 1.8% for crossed K-wire fixations, rather than this being correlated to the direction of preoperative displacement.

Williamson et al. reported a mean BA of 72° for normal elbows, with 95% having had an angle between 64° and 81°. Livermore et al. defined coronal malunion as a BA of >90° or <60° without considering the non-injured arm (carrying angles not measured), rendering the measured BA angles meaningless, since the authors have potentially missed malunions within the 60°–90° range with asymmetric arm alignment. Livermore et al.’s definition of sagittal malunion as the capitellum remaining posterior to the anterior humeral line potentially allowed for clinically significant malunions not to be recognized (potentially up to 45° based on Shank et al.’s reported mean normal lateral capitellohumeral angle of 51°±6°), especially if there was anterior translation of the distal fragment and that therefore the lateral capitellohumeral angle would have been a useful additional measure. Livermore et al. defined malrotation as a difference of ≥5 mm between the distal humerus above and below the
fracture on the lateral radiograph, stating that this yielded a lateral rotation percentage (LRP) of at least 30% in their series, with the former having been based on previous studies which had shown that an LRP of 20% had been defined as significant. However, the 20% was arbitrarily chosen by Bahk et al.6 without established significance. Livermore et al.’s 5 mm cut-off is therefore entirely random and wrongfully dismisses malrotations with a width difference <5 mm, with any step off seen on the lateral radiograph being a sign of malrotation.

In conclusion, Livermore et al.’s radiographic assessments are unreliable to identify correct malunion rates for the various variable groups and therefore do not allow a valid comparison of both surgical techniques, direction of preoperative fragment displacement, and training of the primary surgeon, also considering that 41.7% (10 of 24) of malunions were excluded from the comparison between surgeons and that the vast majority of malunions having been the result of inadequate surgical techniques. Livermore et al.’s conclusion that all-lateral K-wire fixation is associated with an increased malunion rate is not representative for correctly performed all-lateral K-wire fixations as it was described by Skaggs et al.¹ and later by Gottschalk et al.² and Pennock et al.³

**Author contributions**

Mr A.R. MD contributed to the literature review and manuscript preparation. Mr L.G. MBBS contributed to the literature review and manuscript preparation. Mrs E.A. MD contributed to the literature review and manuscript preparation. Mr T.K. PhD, MD contributed to the literature review and manuscript preparation.

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