The Potential Role Of Radiostereometric Analysis In Understanding The Pathology Of Pelvis Ring Disruptions

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Introduction: The in vivo stability of the pelvic ring after fracture stabilisation remains unknown. Plain radiographs have a low accuracy in diagnosing loss of fracture reduction over time. Radiostereometric analysis (RSA) is an accurate imaging measurement method that has previously been applied to measure the healing of other fractures. This pilot study investigated the potential application of RSA in supine and standing positions to measure pelvic fracture stability over time and under weightbearing load.

Methods: Five patients with a similar type C pelvic ring disruption who were all operated on using the same surgical technique and had RSA markers inserted at the time of surgery. All five patients had a unilateral comminuted sacral fracture lateral to the sacral foramina treated with posterior plating and pubic rami fractures stabilised by external fixation for six weeks. All patients were mobilised partial weight bearing after regaining leg control. RSA examinations at 2, 4, 12, 26 and 52 weeks included three radiographic pairs taken in supine, standing and supine positions at each time point. Two additional RSA examinations were performed the day prior and post pin removal at 6 weeks.

Results: All patients ambulated before the 2 week follow-up and progressed uneventfully. At latest follow-up, there were no complications. Minimal displacements (translations less than 0.3mm and rotations less than 0.5°) were recorded between the supine exams pre and post standing at 2 weeks. Hence, the supine examination was found to be a reliable position to measure the migration of the ilium over time.

No loss of reduction was identifiable on plain radiographs over time. At 52 weeks, in contrast to plain radiographic results, RSA measurements revealed that one patient had a fracture migration greater than 4mm. Such large displacements could result in sacral nerve root transection, leading to devastating consequences, such as incontinence, for patients whose sacral fractures are through or medial to the sacral foramina.

In one patient, the migration recorded for the apparent uninjured posterior complex side exceeded the migration of the injured side suggesting an unrecognised bilateral injury.

Comparative RSA examinations pre and post external fixator removal demonstrated that in three patients the injured hemipelvis migrated greater than 2mm after the removal of the external fixator, which may be indicative that the fixator was removed prematurely.

Discussion: The application of RSA allows accurate measurement of pelvic fracture stability which is difficult, if not impossible, to identify and quantify with any other imaging techniques. Hence, RSA has the capacity to enable a better understanding of pelvic ring injuries and optimise their treatment.

Significance: Application of RSA in supine and standing positions allows pelvic fracture stability to be measured more accurately than current techniques. RSA may enable a better understanding of these injuries.

Acknowledgments: References:

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