Comparison of Two Common Imaging Modalities for Evaluation of Fusion Following First Metatarsal Phalangeal Joint Arthrodesis

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STATEMENT OF PURPOSE

Plain film radiographs are commonly used as the gold standard to evaluate fusion across arthrodesis sites. Recent literature has described the use of computed tomography (CT) if pain persists in conjunction with benign plain films in post-surgical arthrodesis. Meanwhile, there are limited resources comparing the timeline of radiographs and CT scans to evaluate first metatarsal phalangeal joint fusion (1st MTPJ) . The purpose of this study is to determine which of the two imaging modalities are more reliable for identification of fusion following arthrodesis of the 1st MTPJ.

METHODOLOGY

A retrospective review was conducted on eight patients with hallux limitus or rigidus who received a 1st MTPJ fusion between January 2017 and July 2017 by the same two surgeons, author KK and AB, at the same hospital. The criteria for inclusion in the study were as follows:

1) Primary 1st MTPJ fusion
2) Post operative radiographs and CT scans were obtained
3) Patient follow up for at least twenty-eight weeks.

Of the eight patients that were identified, all eight met the inclusion criteria.

Serial plain film radiographs and CT scans were performed postoperatively until cortical bridging across the joint was identified. A board certified foot and ankle surgeon reviewed all postoperative imaging evaluating the presence of complete boney bridging and osseous trabeculae across the joint. The radiograph and CT scans were compared at the second postoperative month to determine which imaging modality was more effective at showing bony fusion. If no evidence of complete fusion in both imaging modalities was visualized by the second month, then imaging modalities would be repeated during the following month and compared.

PROCEDURE

The surgical procedure consisted of a dorsal incision made just medial to the Extensor Hallucis Longus tendon. Dissection was carried down to the level of the 1st MTPJ, a capsulotomy was performed and the periosteum was reflected off the head of the 1st metatarsal and base of the proximal phalanx. A sagittal saw was then used to resect the osteophytes off the metatarsal head. The 1st MTPJ was prepped using a cannulated anatomical reamer, until cancellous bleeding bone was visualized. The surfaces were then fenestrated using a 0.062 k-wire. Anatomical alignment and length of the metatarsal was achieved under intraoperative fluoroscopy. The joint was then fixated and compressed using either two crossing screws or a compression screw with a low profile locking plate and screws. Layered closure was performed.

Postoperatively: All patients were instructed to be non-weight bearing (NWB). Plain film radiographs were performed every two weeks. CT scans performed at two months postoperatively and month three, if necessary.

RESULTS

In seven out of the eight patients, cortical bridging across the 1st MTPJ was noted at the second postoperative month upon evaluating plain films. In one patient, fusion at the surgical site was not seen at three months in either plain films or the CT scan. In this study, the statistical data shows that plain film radiographs will show fusion across the 1st MPJ earlier than CT scans. Therefore, it can be deemed that plain film radiographs may falsely show complete fusion.

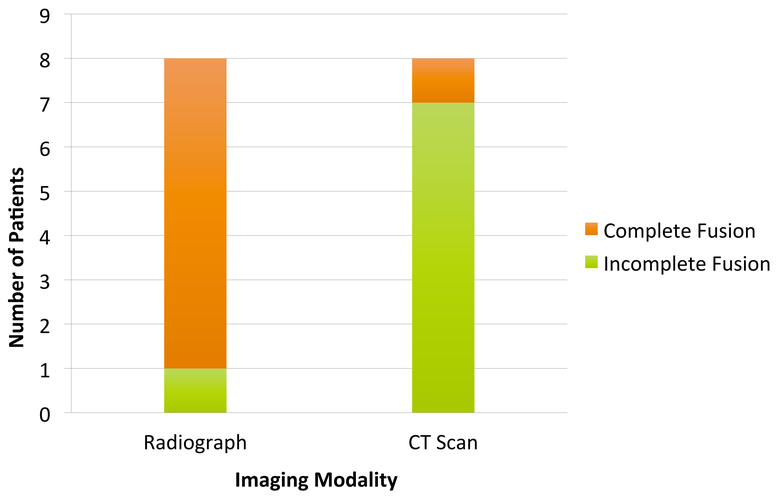

Figure 1: During the second postoperative month both plain films and CT scans were performed on the eight patients. Upon evaluation, seven out of the eight patients showed cortical bridging across the 1st MPJ when looking at a plain film, verse one of eight in a CT.

DISCUSSION

Plain films are widely used to evaluate cortical bridging across an arthrodesis site, because they are readily available, easy to evaluate and come at a low cost. However, it may not provide an adequate evaluation of bony fusion across the joint. Allowance of early return to unprotected weight bearing due to apparent cortical bridging in radiographs could lead to delayed or nonunion from the premature micro-motion at the joint. CT scans should be ordered at 6-8 weeks post operatively once fusion is identified on plain film radiographs to help ensure complete union at the arthrodesis site before returning the patient to their activities of daily living.

CONCLUSION

Radiographs can falsely show complete boney fusion compared to CT scans when evaluating forefoot joints. CT scans are more effective at showing cortical bridging across arthrodesis sites when compared to radiographs. Therefore, CT scans should be ordered at two months post operatively before returning the patient to complete unprotected weight bearing, along with clinical evaluation.

Image 1: Lateral foot plain film radiograph at two months postoperatively showing bony fusion following 1st MTPJ arthrodesis

Image 2: Oblique plain film of foot at two months postoperatively showing complete bony fusion following 1st MTPJ fusion

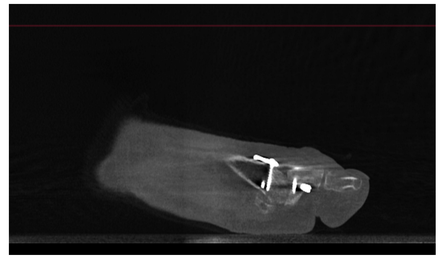

Image 3: Sagittal foot CT scan at two months postoperatively showing incomplete bony fusion following 1st MTPJ fusion

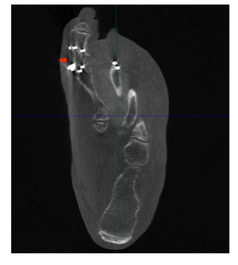

Image 4: Axial foot CT scan at two months postoperatively showing incomplete bony fusion following 1st MTPJ arthrodesis

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