



# First Metatarsophalangeal Joint Injections: The ‘Sulcus Sign’ Technique

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## Abstract

A first metatarsophalangeal joint injection is a very useful diagnostic and therapeutic technique used in a range of pathologies afflicting this joint. We describe a novel technique for obtaining accurate intraarticular needle positioning which is simple to perform and avoids the morbidity associated with multiple injection attempts.

## Introduction

The first metatarsophalangeal joint is a synovial, condyloid anatomical structure formed by the convex head of the metatarsal and the concave base of the proximal phalanx. The joint is stabilized by the joint capsule, plantar metatarsal ligament and the collateral ligaments (including the medial and lateral sesamoid phalangeal ligaments which attach proximally to the sesamoids which in turn are attached to the flexor hallucis brevis, abductor hallucis and both heads of adductors hallucis [1]. Consequently, the movements possible at this joint include plantar flexion, dorsiflexion, abduction, adduction and circumduction. Dorsiflexion/plantarflexion (80:30) accompanied by adduction, abduction and some circumduction allows the toe to remain stable to the ground with respect to varied positions of the rest of the foot [2]. With more dorsiflexion possible than plantarflexion more force is transmitted to the dorsal 50% of the metatarsal head and the corresponding proximal phalanx and therefore the dorsal metatarsal head tends to degenerate primarily [3]. This can result in a first metatarsophalangeal joint which may be variable in size and shape.

A range of conditions can afflict the first metatarsophalangeal joint. Injections here can be both diagnostic and therapeutic and arthrocentesis can yield diagnostic information in the setting of joint effusions. Techniques have ranged from ‘traditional’ palpation guided injections, to fluoroscopically guided or ultrasonographically guided intraarticular needle insertion.

Coughlin and Shurnas have classified degenerative joint disease and hallux rigidus with grades 3 and 4 including patients with greater than 50% joint space narrowing and severe dorsal osteophytes [4]. Due to this there has been a general trend to guide injections with the use of ultrasonography. This has its own advantages including the fact that it is cost-effective, has no ionizing radiation, allows for identification of neurovascular structures and tendons and allows for real-time imaging of the joint as the needle is advanced into it [5]. Although it has been widely successful at confirming intraarticular positioning some clinicians have criticized it’s accuracy as being operator dependent. Balint et al. performed a study comparing palpation guided arthrocentesis vs. ultrasonographic guidance and found 97% success at aspiration in the ultrasonographic guided group compared to the palpation only group where only 32% of joints were successfully aspirated [6,7].

## Aims and Objectives

We present a new technique for identifying the first metatarsophalangeal joint line accurately and allowing intraarticular needle placement. This technique for identifying the joint line can be used to supplement either non-image guided injections of the joint or image guided injections. We then, evaluate our technique.

## Description of Technique

The patient is positioned supine on the operating room table with 2 pillows beneath the knee allowing the foot to rest flat on the table. The foot is prepared and draped using chlorhexidine spray to the skin. The fluoroscopy machine is positioned on the contra lateral side of the table. Distal traction is applied to the great toe. This opens the joint space and a sulcus is visible lateral to the extensor hallucis longus tendon to avoid injury to the medial dorsal branch of the superficial fibular

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**Figure 1:** Superficial fibular nerve.

nerve (Figure 1). This is the 'sulcus sign'. Palpation can now be used to identify the base of the proximal phalanx and the metatarsal head. A needle is inserted in the centre of the sulcus between the proximal phalanx and metatarsal. The angle of insertion is 60 to 70 degrees with the tip of the needle aimed distally with a dorsolateral entry point. Intraarticular needle positioning can be confirmed using fluoroscopy. Aspiration of the joint can be performed followed by injection if an injection is planned. A clean dressing is subsequently applied.

### Methodology Evaluation

Thirty (30) patients were included in this study. Prior to needle insertion the joint line was marked by the surgeon performing the procedure. The point of insertion was identified using the 'sulcus sign' technique described above. This was then compared to the actual point of insertion following fluoroscopic identification of the joint line. The distance from the actual fluoroscopically identified joint line to the marked joint line identified using the 'sulcus sign' technique was measured and recorded using a technique similar to Manadan et al. [8].

### Results

Our study showed that there was no difference between the actual joint lines identified using image guidance versus the 'sulcus sign' technique. There was also no difference in the point of needle entry marked using either technique. In all 30 cases we found that use of the sulcus sign allowed accurate identification of the joint line and accurate needle placement with only a single attempt required to establish an intraarticular position in patients with advanced degenerative changes of the joint. There were no adverse reactions.

### Discussion

Our technique allows for a shorter time taken to complete the procedure and allows for an accurate and reproducible method of identifying the joint line. It can be used as a supplement if image guidance is going to be performed or it can be used in situations where image guidance is unavailable or abandoned. This is ultimately the decision of the clinician performing the procedure though we are aware that currently the literature supports ultrasonographic guidance [4,6-8]. Coughlin and Shurnas grades 3 and 4 sufferers were not excluded from this study. Patients with advanced degenerative changes and a greater than 50% reduction in joint space specifically may benefit from the 'sulcus sign' technique as the manual distraction required to create the sulcus sign temporarily widens the joint space and reduces the chance of needle malposition on dorsal osteophytes.

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