 doi:10.20944/preprints202210.0484.v1

# Use of intra-articular injection corticosteroid injections to the first metatarsophalangeal joint. First theme of a scoping review

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 doi:10.20944/preprints202210.0484.v1

**Abstract**

Introduction. A needle is inserted into a joint for arthrocentesis or injection of a therapeutic medication(s), commonly a corticosteroid. The aim of this paper is to discuss the first theme identified from a scoping review of corticosteroid injections for the pathology of the first metatarsophalangeal joint.

Pathology. The two most common pathologies affecting the first metatarsophalangeal joint are osteoarthritis and bunions. An arthritic joint is regularly injected with a corticosteroid, but bunions are not. Other pathologies that may receive an injection include rheumatoid arthritis, gout, sesamoiditis and post-operative arthrofibrosis.

Discussion. Most available evidence discusses corticosteroid injections for osteoarthritis, but there is a paucity of high-quality evidence, especially for corticosteroid use in other pathological conditions.

Conclusion. Whilst the evidence base suggests that corticosteroid injections are safe short- and mid-term treatment options for a range of soft tissue and joint pathology, the specific indications, and short/long-term outcomes in the first metatarsophalangeal joint pathologies are not clear and warrant further study.

Keywords. Steroid injection, synovial joint, first metatarsophalangeal joint, hallux limitus, hallux rigidus, hallux valgus, gout, arthrofibrosis.

## Introduction

As part of a scoping review, the senior author has discussed[1] the general indications for the intra-articular (IA) insertion of a needle into a joint: for diagnostic arthrocentesis or injection of a therapeutic medication(s)[2–7]. Therapeutic injections of corticosteroids provide a treatment option for patients with joint or

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peri-articular pain, and injection therapy (IT) is now one of the most common and widely performed interventions in musculoskeletal healthcare[8–17], see Fig. 1 (patient of the senior author).

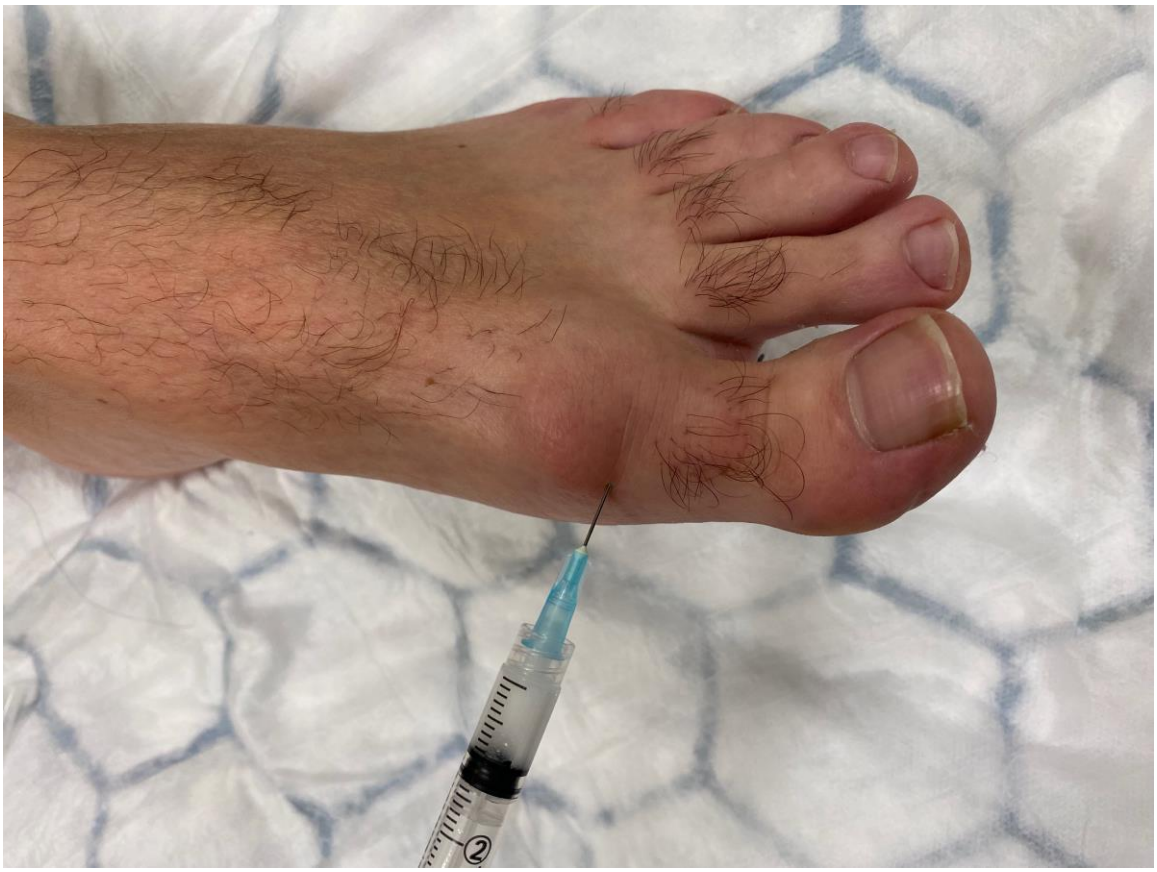

**Figure 1: intra-articular CSI for hallux limitus**

The objectives of the doctoral project are to identify, synthesise and critique the evidence base for the use of corticosteroid injections (CSIs) in the management of first metatarsophalangeal joint (1st MTP jt) pathology, to highlight gaps in the knowledge base and to generate research questions for future study. The first part of the project was a scoping review (which is being reported more fully elsewhere). The literature search yielded 193 articles, 48 of which appeared of potential relevance. After removing duplicate articles, this total was reduced to 37 articles: 27 were excluded after review to leave ten articles; a further 28 articles were found through related author research, examination of reference lists and free text

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searches of Google Scholar. One reference was unobtainable, giving a final count of papers utilised for review was 37. Iterative charting of the literature yielded three broad and overlapping themes:

1. Evidence of IA CSIs by joint disease/pathology,
2. Non-evidenced based descriptions of injection technique and regimen,
3. Accuracy of 1st MTP jt injection.

Nineteen papers discussed and overlapped to produce themes 1 and 2. This paper aims to discuss the first theme identified from that scoping review.

**Pathology of the 1st MTP jt.**

The two most common pathologies affecting the first metatarsophalangeal joint (1st MTP jt) of the foot are OA - hallux limitus/rigidus and bunion - hallux abducto valgus (HAV)[18,19]. Injectable CSIs are widely used in hallux limitus[20–45] but they are rarely used in the pre-operative management of HAV joint pain. However, they are employed for post-operative stiffness and pain that can occur as a result of surgery: arthrofibrosis[18,46]. Other pathologies of the joint include rheumatoid arthritis (RA), gout and sesamoiditis[47]. CSIs can be both diagnostic and therapeutic in sesamoiditis[30,48–50]. While joint fluid aspiration and CSI are commonly performed for gout[51,52] its use has not been investigated by controlled trials[53–55]. However, the authors note that intra-articular (IA) CSIs for gout are recommended by the British Society of Rheumatology (BSR)[56], the European League against Rheumatism[57], and the American College of Rheumatology (ACR)[58].

**Osteoarthritis**

In a retrospective analysis of 772 patients with symptomatic hallux limitus by Grady et al.[28], 428 patients (55%) of the cohort were successfully treated with conservative care alone. Twenty-four patients (six per cent of those treated conservatively) were given CSIs injections. Of these patients, 18 received one

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injection; five received two injections, and one had three injections; injections were given four weeks apart where required, i.e., if the patient had more than 50% but less than 80% improvement.

Grice et al.[59] performed a retrospective of all patients who underwent ultrasound (US) guided CSI of the foot or ankle (all conditions) over a one-year timescale in a similar manner to that of Ward et al.[41] (though that paper is not referenced). All injections were performed by a consultant musculoskeletal radiologist and reviewed at least two-years post-treatment. 314 out of 365 (86%) of patients included in the study had significant improvement in symptoms, but the longevity of outcome varied across the range of pathology injected. Short-term benefit was seen for HL/HR: 20 of 22 (91%) patients reported benefit from the injection, but only three (14%) reported that the improvement lasted longer than six months. At two years post-treatment, only two patients (9%) remained asymptomatic; 12 patients (55%) had undergone surgery. The authors concluded that injections should be reserved for those with mild OA, but they did not break down the HL/HR group by the extent of disease, i.e., mild, moderate, or severe OA, so it is not clear how they reached that conclusion. The applicability of context and profession (US-guided CSIs performed by a consultant musculoskeletal radiologist) is open to further debate as 1st MTP jt CSIs are commonly performed non-guided.

Kilmartin[30] writes that CSIs can be a very effective treatment for joint pain associated with mild-to-moderate HL and HAV, and for continued pain and stiffness following surgical intervention to the 1st MTP jt.

In a comprehensive review of the non-operative management of HL/HR, Kon Kam King et al.[45] found insufficient evidence to support the use of IA CSIs for pain relief for three months, and fair evidence against the use of IA CSIs for long-term

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efficacy. However, the methodology was neither systematic nor comprehensive: only a single database was searched for clinical trials, and the risk of missing pertinent literature is high. The authors' recommendations were made based on an appraisal system that allocates a level of evidence for an intervention based on the identified studies' design without consideration of the methodological quality of trials, or the risk of bias. The trials identified in this review lacked heterogeneity in terms of solutions tested and the design of trials. Despite this, the authors grouped six trials relating to IT together for data analysis, and a collective level of evidence was allocated to IT as a whole.

Pons et al.[33] evaluated the effectiveness and safety of 1.0ml of IA sodium hyaluronate (SH - Ostenil® mini) compared to 1.0ml of IA triamcinolone acetonide (TA) in 37 patients with early HR. Patients were evaluated on days 0, 14, 28, 56 and 84 with effectiveness measured on joint pain at rest or on palpation, passive motion and gait pain, the American Orthopedic Foot and Ankle Society (AOFAS) hallux metatarsophalangeal score, the use of analgesics and the global assessment of the treatment by the patient and investigator. Pain at rest or with palpation and pain on passive mobilisation decreased significantly in both treatment groups. Gait pain improved substantially in the SH group with significant differences compared to the TA group at days 28 and 56. The AOFAS total score improved significantly in the SH group compared to the TA group. This paper was poorly titled in that use of a comparative CSI was not mentioned. The trial had a small sample size with a female gender bias, and interventions were administered to participants with both 1st MPJ OA *and* hallux valgus with no sub-group analysis provided according to condition.

Sarkin[36] briefly describes his treatment results with IA CSI in an unselected group of patients with OA of the ankle and 1st MTP jt. He suggests that for IA CSIs to be

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of value, there must be no HAV deformity and at least 45° of free movement retained in the affected joint.

Manipulation under anaesthesia (MUA) of the 1st MTP jt joint was first described by Watson Jones in 1927[60] to break down the capsular adhesions that restrict movement. Solan et al.[37] report the results of MUA in combination with an IA CSI of 40mg of depo-medrone/3ml 0.5% bupivacaine plain, carried out on 37 joints, with a minimum follow-up of one year across a range of disease staging. Patients with grade I (mild) changes gained symptomatic relief for a median of six months and only one-third in this group went onto surgery. Two-thirds of patients with grade II (moderate) disease proceeded to open surgery and only had symptomatic relief for three months. Little symptomatic relief was obtained in grade III (advanced) HR, and all patients required operative treatment. The authors recommend that joints be graded before treatment and that MUA with CSI should only be used in grades I and II HR. This paper is regularly quoted in the literature and though over 20 years old, it has not been repeated. Nevertheless, it is considered a landmark study to predict outcomes for pedal CSIs with reference to radiological disease presentation. However, we do not know whether CSI, the local anaesthetic, the manipulation, or a combination, is responsible for the benefits seen. The lower numbers (five) in the grade III sample further limit confidence in the conclusions drawn.

Ward et al.[41] studied the long-term efficacy of CSIs in foot and ankle joints, stating that most evidence for the efficacy comes from studies of the knee, with fewer studies considering the joints of the foot and ankle. Eighteen patients were enrolled in their prospective study and a foot-related quality of life questionnaire before CSI and at seven set points post infiltration. They found a statistically significant improvement following CSI up to and including six months post-injection and that the magnitude of the response at two months was found to

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predict a sustained response at nine months and one year. Many patients were lost to follow-up, and the authors admitted that their sample size was small and that injections were not performed to a standardised technique. All pathologies were aggregated into the results: only one MTP jt is included (which may or may not be the 1st MTP jt). The conclusion is clinically useful but cannot be applied to the 1st MTP given the sample for this paper.

Zammit et al.[61] produced a Cochrane Review evaluating interventions for OA of the 1st MTP jt to determine the optimum intervention(s). Only one trial satisfactorily fulfilled the inclusion criteria and was included in their review: that trial evaluated the effectiveness of two physical therapy programs. The paper by Pons et al.[33] was excluded from their analysis as both HL/HR and HAV patients were included in that cohort, as noted above.

Many other sources briefly comment on the use of IA CSIs for the treatment of HL/HR. For example, Vanore et al.[62] note that judicious use of CSIs may provide rapid relief of pain even in recalcitrant cases of HL/HR.

**Rheumatoid arthritis**

While many articles cite the use of injectable CSIs for inflammatory arthritis (RA or spondyloarthropathies), very little is written on foot pathology, and even less for the great toe[2,63,64]. Nordberg et al[65] included all five MTP jt CSIs in their study to investigate whether US in combination with clinical examination is better at identifying joints that will benefit from IA CSIs compared to identification by clinical examination alone, as well as determining the efficacy of US-guided versus palpation-guided procedures. The data presented was aggregated and not broken down by anatomical site.

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**Gout**

Fernandez et al.[66] reported on a case series of 19 patients who received IA TA for acute gout attacks in 11 knees, four 1st MTP jts, three ankles and two wrists. Patients were given 10mg in knees and 8mg in small joints. Based on visual analogue scores (VAS), 11 joints were resolved within 24 hours, and the remaining nine were resolved within 48 hours. No patients presented for return of pain in the initial joint within the next 30 days.

Kang et al.[52] published a trial with 21 patients evaluating the safety and efficacy of IA CSIs for acute gout flare of the 1st MTP jt. The affected joint was injected with 0.5ml (20mg) TA with 0.5ml of 2% lidocaine under US guidance. All 21 patients experienced significant improvement in pain, general disability, and walking disability within 48 hours post-treatment. No adverse events occurred within the first seven days post-injection.

In a consensus statement by the American College of Foot and Ankle Surgeons via a Delphi study[54], the panel was unable to reach a consensus on the statement: *Joint injections are preferred over oral steroids as initial treatment of acute gout*. The panel reviewed the literature and could not locate any high-level evidence of randomised or controlled studies in the use of IA CSIs for the treatment of gout, citing the two studies mentioned above.

In a Cochrane review, Wechalekar et al.[55] found that there is no evidence from randomised clinical trials (RCTs) to support the use of IA CSIs treatment in acute gout but that as the evidence suggests CSI may be a safe and effective treatment in OA and RA, that these results may be generalisable to people with acute gout, especially when non-steroidal anti-inflammatory drugs or colchicine are contraindicated.

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**Sesamoiditis**

Sims and Kurup[50] suggest that injections are usually done under radiological guidance to improve the accuracy of needle placement but that they should not be used in the presence of a sesamoid fracture or avascular necrosis. Kilmartin[30] suggests that 1ml of depo-medrone (40mg) can be placed in the soft tissues just superficial to the involved sesamoid - but not into the plantar fat pad - and repeated on up to three occasions. This contrasts with his earlier statement in the reference where he recommends betamethasone (as a non-particulate injection) for joints. This contrasts with Wempe et al.[67] who demonstrated that the metatarsophalangeal-sesamoid complex is continuous and can therefore be approached through a standard dorsal 1st MTP jt IA technique. Cohen[68] counsels against repeated injections for sesamoiditis.

The patient in Fig. 2 (a patient of the senior author) underwent magnetic resonance arthrography (MRI) for sesamoiditis and a partially ruptured medial collateral ligament and partial plantar plate tear (yellow arrow) following a football (turf toe) injury. Gadolinium, injected as a contrast medium into the joint before scanning can be seen as a collection of fluid in the plantar-posterior aspect of the synovial membrane. He was given a small (10mg) dose of IA triamcinolone acetonide and was pain-free within seven days.

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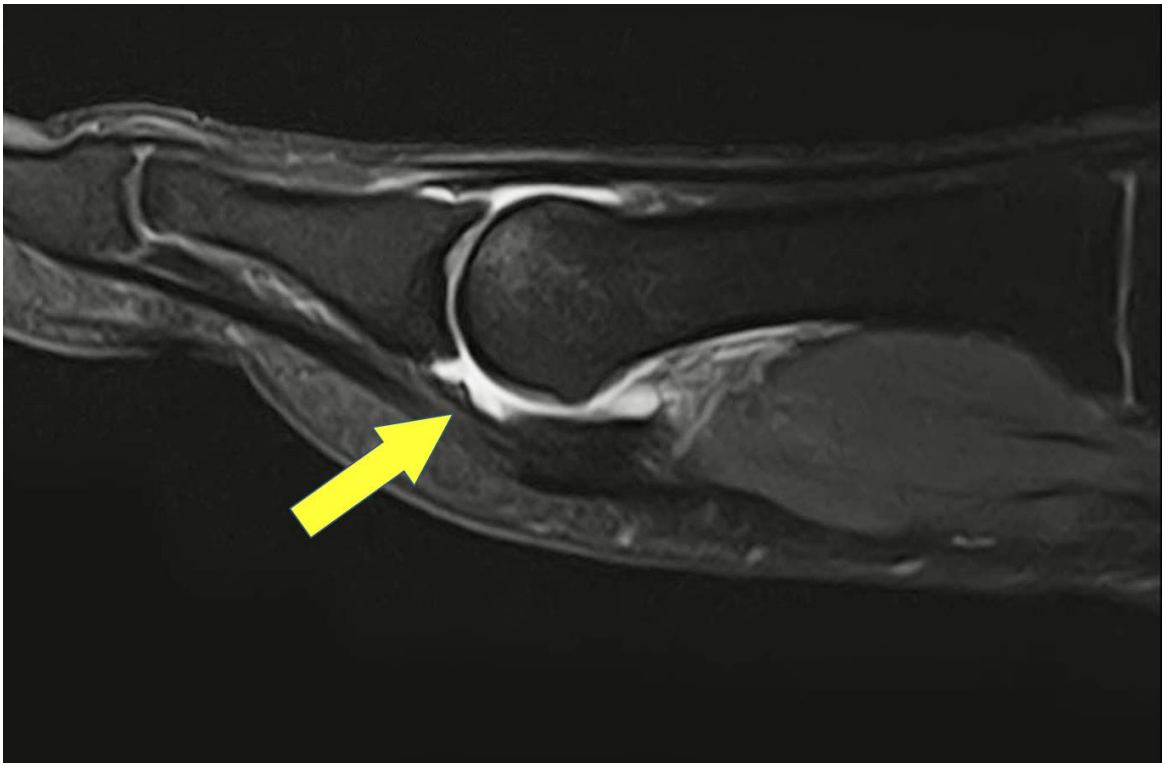

Figure 2: MRI arthrography of 1st MTP jt

**Post-operative arthrofibrosis**

Ajwani et al.[18] reported their findings to determine the effectiveness of MUA and local steroid injection to treat stiffness of the 1st MTP jt following surgery for HR or HAV. Patients who had undergone 1st ray surgery and were subsequently treated for joint stiffness with MUA and CSI were reviewed. The injectate was a mixture of 40mg/1ml of methylprednisolone and 0.5% bupivacaine plain. The modal volume used was 1ml but ranged from 0.5ml to 4ml. Patient records were reviewed to determine the range of movement of the joint pre-operatively, immediately following the procedure and at subsequent follow-up, using the Manchester-Oxford foot questionnaire (MOxFQ) to evaluate symptoms post-operatively. The authors analysed 35 patients in 38 feet: 27 post-HR surgery and 11 post-HAV corrections. The total range of movement of the joint improved following treatment by an overall mean of 44.7°. At subsequent follow-up, the total range of motion of the joint was still improved by 22.2° overall. The mean post-operative MOxFQ score was 24.8 but no correlation was found between MOxFQ

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scores and range of movement. They concluded that MUA/CSI is an effective way of treating stiffness following 1st ray surgery and that treatment results in an improved range of motion of the joint, and patients report good function post-operatively.

While the range of motion was reported to improve, the authors note that measurements were performed by registrars and consultants in a clinic or theatre setting without the use of a goniometer. This could infer inter- and intra-rater variability and repeatability of data collection, but the trend is clear. Of note, 78% of the HR group had grade III OA. As per Solan et al.[37], we cannot determine from the study whether the manipulation (breaking down the arthrofibrosis), the local anaesthesia (blocking the pain reception) or the CSI (the effects and side effects of the CS) - or a combination - was/were responsible for the favourable outcome.

Feuerstein et al.[46] investigated the outcomes of 1st MTP jt CSI and manipulation for arthrofibrosis that occurred as a complication of HAV surgery. The study population consisted of 53 feet in 38 patients. Under sedation and regional nerve block, their 1st MTP jt was distracted; repeated attempts were then made to forcibly dorsiflex and plantarflex the toe until the capsular adhesions restricting motion had loosened and the movement was improved in the toe. The joint was then injected with 2ml of methylprednisolone acetate (40mg/1mL) mixed and 3ml of 0.5% bupivacaine plain. A significant increase in range of motion and a decrease in pain scores was seen, and the authors suggest that their technique is a valuable modality in patients who experience arthrofibrosis after surgical correction of HAV. As mentioned above, it is not possible to say which part of the technique is the most important for the overall outcome.

The patient in Figs. 3-7 (a patient of the senior author) underwent a Youngswick decompressive osteotomy for HL in 2017. Three years later, she developed HR of

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the joint with stiffness and a visual-analogue (VAS) pain scale of 8/10. She underwent a MUA/CSI using 30mg IA TA in 2020 and rates her pain at 2/10 six weeks post-treatment.

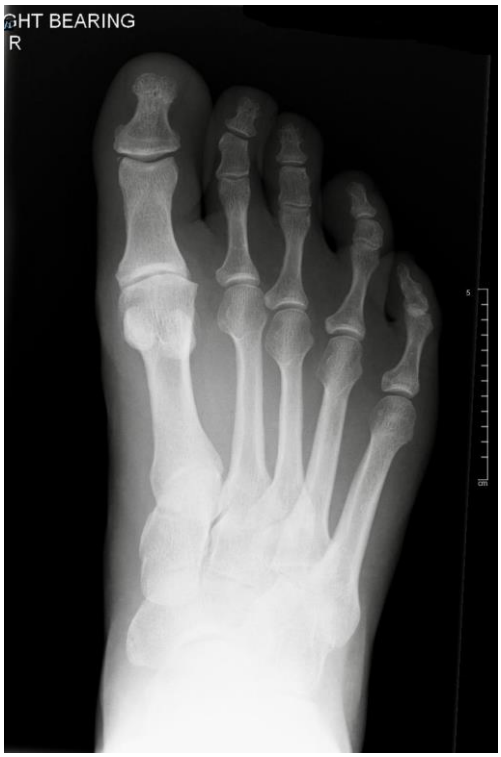


Figure 3: 2016 Pre-operative X-ray

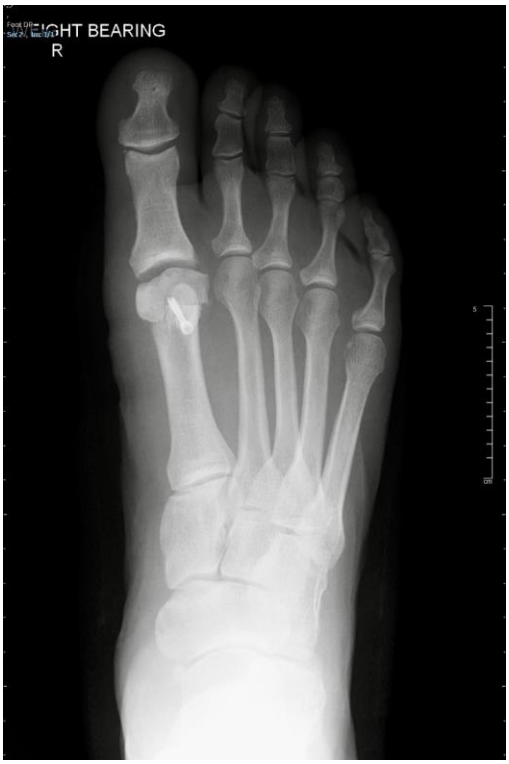


Figure 4: 2016 Post-operative X-ray

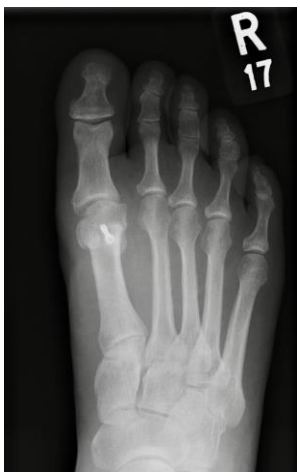


Figure 5: 2019 X-ray - moderate OA

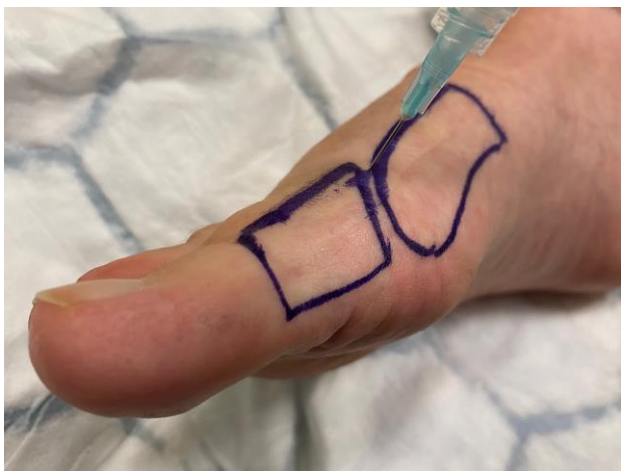

Figure 6: CSI lateral view

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## Discussion

IA CSIs are used for a variety of 1st MTP jt pathology with a predominance in the literature for their use in HL/HR. Uthman et al.[38] note that despite the lack of strong, convincing, and reproducible evidence that any of the IA IT significantly alters the progression of OA, CSIs and SH are widely used in patients who have failed other therapeutic modalities. Cole and Schumacher[69] also note that despite the scarcity of high-quality clinical trial data, there is a large body of literature related to injectable CSIs. Urits et al.[13] state that injections provide an effective financial alternative and that some evidence exists that they are effective in chronic pain alleviation. However, they also note that current evidence is limited and that the benefit described by IT is short-lived in most cases. However, the literature shows that CSIs of joints and periarticular structures are safe and effective when administered by an experienced physician.

Reilly et al[70] performed a systematic review to determine if good quality research exists to enable clinicians to adopt an evidence-based approach to 1st MTP jt CSIs for OA. Despite the frequency of use, the review found no high-quality studies that support their use. The wider literature suggests that IA CSIs are effective for short-term relief of pain in OA but predicting the best responders is not currently possible. Specific corticosteroids are recommended for different joints by various authors according to their size. In general, the literature suggests that for:

- For smaller joints: methylprednisolone/hydrocortisone is recommended
- For larger joints: methylprednisolone or triamcinolone is recommended

A key objective of the scoping review was to generate questions for future research studies. The focus of future research should be on the use of CSIs for 1st MTP jt OA as this is the most frequent indication for IT, but high-level studies also need to be conducted for the role of IA CSI in the management of HAV (of which there is an almost total absence from the current literature), acute gout, sesamoiditis and

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arthrofibrosis. Arthrofibrosis is one of the most seen complications after HAV surgery and specifically warrants further consideration for research and evaluation of treatment outcomes.

This scoping review was limited to a completion date as part of a professional doctorate degree course and further limited to the inclusion of only those papers that met the criteria set out in the search parameters. Any articles outside of this availability (i.e., the grey literature) were not used, and no financial budget was set. Therefore, both financial and time constraints have meant that some limitations to the depth and breadth of the review might be extant.

**Conclusion**

The article concludes as many do, that more research is needed. Whilst the evidence base suggests that CSIs are safe short- and mid-term treatment options for a range of soft tissue and joint pathology, the specific outcomes in the 1st MTP jt for a given condition are opaque and warrant further study. It is not clear what drug, at what dose, and at what point in disease regression is optimal for a given patient.

**Declarations**

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors have no competing interests to declare. IR conceived the aim and format of the paper. The manuscript has been read and approved by both the authors.

**Acknowledgments**

The authors gratefully acknowledges the support and guidance of Prof. Roozbeh Naemi (module leader, Professional Doctorate in Healthcare Science) and Prof. Nachi Chockalingam (research supervisor) at Staffordshire University.

Our appreciation also goes to the Departments of Research and Innovation (for ethical approval) and Podiatric Surgery (for the use of clinical photographs, with consent for publication granted from the patients), of Northamptonshire Healthcare Foundation NHS Trust (NHFT).

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