International Centre for Allied Health Evidence

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Systematic Review of the Literature

The effectiveness of injection of steroid to the hand as a form of interventional pain management

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Citation details
The International Centre for Allied Health Evidence (2016). Systematic review of Literature: The Effectiveness of injection of Steroid with or without Local Anaesthetic to the Hand as a form of Interventional Pain Management: Technical Report. Prepared for the Accident Compensation Corporation, New Zealand.

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Abbreviations

The following abbreviations are used in this report and are collated here for readers' convenience.

Abbreviation		Abbreviation	
ADL	Activity of Daily Living	**NaCl**	Sodium Chloride
AROM	Active Range of Movement	**NNT**	Number-to-treat
CES-D	Center for Epidemiologic Studies-Depression Scale	**NRS**	Numerical Rating Scale
CI	Confidence Interval	**NSAID**	Non-Steroidal Anti-Inflammatory Drugs
		OA	Osteoarthritis
CSI	Corticosteroid Injection	**PCS**	Pain Catastrophizing Scale
DASH	Disability of Arm, Shoulder, & Hand questionnaire	**PICO**	Population, Intervention, Comparator, Outcome
DUTCH AIMS-2-HFF	Dutch Arthritis Impact Measurement Scales	**PLA2**	Phospholipase A2
DX	Dextrose Injection	**PPI**	Proximal Phalanx Injection
EPB	Extensor Pollicis Brevis	**PPR**	Percutaneous A1 Pulley Release
FI	Fluoroscopy	**RCT**	Randomised Controlled trial
HA	Hyaluronic acid	**RR**	Risk Ratio
HAQ-DI	Health Assessment Questionnaire Disability Index	**SIGN**	Scottish Intercollegiate Guidelines Network
MA	Meta-analysis	**SMD**	Standard Mean difference
MAI	Mid-axial Injection	**SR**	Systematic Review
MD	Mean Difference	**SRM**	Standardized Response Mean
MHLC	Multidimensional Health Locus of Control	**TAM**	Total Active Motion
MHQ	Michigan Hand Outcome Questionnaire	**TMC**	Trapeziometacarpal
MRI	Magnetic Resonance Imaging	**US**	Ultrasound
MSN	Miniscalpel-Needle	**VAS**	Visual Analogue Scale
Quality Ratings		**Quality Ratings**	
AQ	Acceptable Quality	**LQ**	Low Quality
CS	Can't say	**NA**	Not Applicable
HQ	High Quality	**R**	Reject (Unacceptable Quality)
QS	Quality of Study		

EXECUTIVE SUMMARY

Objective of the Review	The objective of this systematic review is to synthesise the evidence related to the effectiveness of injection of steroid with or without local anaesthetic to the hand as a form of interventional pain management. In order to review the evidence this review aims to answer the following research questions: 1. What is the evidence for the effectiveness of steroid injections to the hand in relieving pain and/or in improving functional outcomes in patients with pain? 2. What is the evidence for the safety of steroid injections to the hand with or without local anaesthetic?
Evidence sourced	The search yielded 2,316 articles. After scrutiny, 2,268 articles were excluded as duplicates or failing to meet the inclusion criteria (shown in Figure 1), leaving 48 studies for inclusion in this review. This included 16 systematic reviews (SRs), 19 randomised controlled trials (RCTs), and 13 cohort/case studies. One RCT reported in this review included two disease types and is therefore reported twice, i.e. within each disease type.
What is the evidence for the effectiveness of steroid injections to the hand in relieving pain and/or in improving functional outcomes in patients with pain?	**<u>First carpometacarpal joint</u>** • **The evidence suggests that steroid injections for thumb-base osteoarthritis should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on conflicting results from one LQ SR, one AQ SR and one AQ RCT. • **The evidence suggests that the effectiveness of steroid injection compared to hyaluronate injection for relief of pain in thumb-base osteoarthritis remains unclear.** Level B Recommendation based on conflicting results from one LQ SR and one AQ SR. **<u>de Quervain's disease (stenosing tenosynovitis affecting base of thumb)</u>** • **The evidence suggests that steroid injections are effective in reducing pain and improving function in patients with de Quervain's disease.** Level A Recommendation based on two HQ SRs and one HQ RCT. • **The evidence suggests that steroid injections are more effective in reducing pain and improving function in patients with de Quervain's disease when combined with hand therapy.** Level B Recommendation based on one HQ SR. **<u>Trigger finger (digital flexor tenosynovitis)</u>** • **The evidence suggests that steroid injections are effective in reducing pain and improving function in patients with trigger finger compared to placebo.** Level B Recommendation based on one HQ SR. • **The evidence indicates that steroid injections are less effective than percutaneous A1 pulley release for pain and recurrence in patients with trigger finger.** Level B Recommendation based on the results from one HQ RCT and one

	AQ RCT. • **The evidence suggests that steroid injection with lidocaine is more effective than injection of lidocaine alone in reducing pain.** Level B Recommendation based on one HQ SR. • **The evidence suggests that steroid injections are as effective as extracorporeal shock wave therapy alone in reducing pain.** Level B recommendation based on one HQ SR. • **The evidence indicates that steroid injections are not as effective as open surgery for reducing pain in patients with trigger finger.** Level B recommendation based on results from one HQ RCT. • **The evidence indicates that the effectiveness of steroid injections for reducing pain and improving function is improved when used in combination with hyaluronate injections in patients with trigger finger.** Level B recommendation based on results from one HQ RCT and one LQ RCT. **<u>Dupuytren's disease</u>** • **The evidence suggests that steroid injections for Dupuytren's disease should not be first line of treatment as the evidence remains unclear**. Level B Recommendation based on one HQ SR. **<u>Ganglion cysts</u>** • **The evidence suggests that steroid injections for ganglion cysts should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on one LQ SR.
What is the evidence for the safety of steroid injections in the hand?	**Minor complications associated with steroid injections to the hand are not uncommon, but rarely require significant medical attention.** Level A recommendation.
What is the evidence for differences in effectiveness if imaging is used?	**The evidence indicates that ultrasound guided injections are:** • **No better than blinded steroid injections for pain and function in patients with trigger finger.** Level C Recommendation based on results from one LQ RCT. • **Better than manual steroid injections for pain in patients with de Quervain's disease.** Level B Recommendation based on results from one AQ RCT.
Does the evidence report any information about cost effectiveness?	**This review found no evidence related to the economic implications of steroid injections to the hand as an interventional pain management treatment.**

1. Background

1.1 Objective of this Review

The objective of this review is to synthesise the evidence related to the effectiveness of injection of steroid with or without local anaesthetic to the hand as a form of interventional pain management. It will carry out a systematic review of the best available research evidence.

The review aims to answer the following research questions:

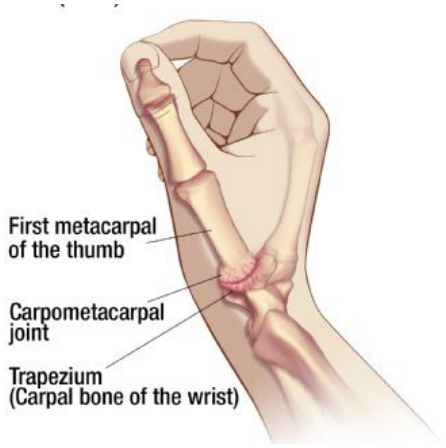
a. What is the evidence for the effectiveness of steroid injections in patients with pain in the hand?
b. What is the evidence for the effectiveness of steroid injections in improving functional outcomes in patients with pain in the hand?
c. What is the evidence for the safety of steroid injections in patients with pain in the hand?

1.2 Description of the Intervention

Pain in the hand region can come from a range of structures and pathologies. When considering the evidence related to the use of steroids for pain in the hand region the most common clinical conditions for which steroid may be used as an interventional pain management technique are for pathologies involving the first carpometacarpal joint, de Quervain's disease, trigger finger (i.e. digital flexor tenosynovitis) and ganglion cysts (Tallia and Cardone 2003).

First Carpometacarpal Joint

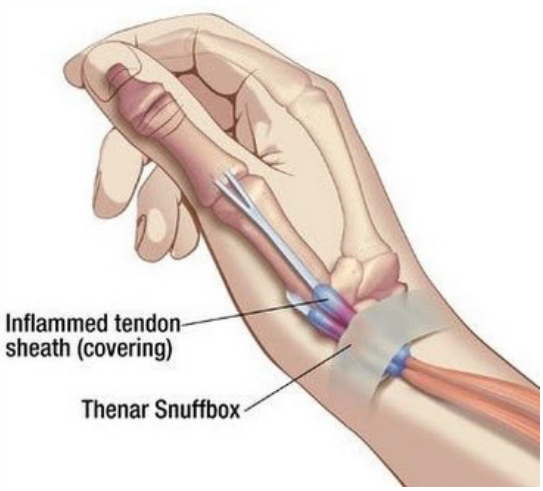
The movements of the thumb are controlled in part by the saddle-shaped articular surface of the base of the first metacarpal, which articulates with the trapezium. This joint is commonly affected by osteoarthritic changes or through overuse, which can also be known as thumb base osteoarthritis.



(Adapted from: www.ohmyarthritis.com)

de Quervain's Tenosynovitis

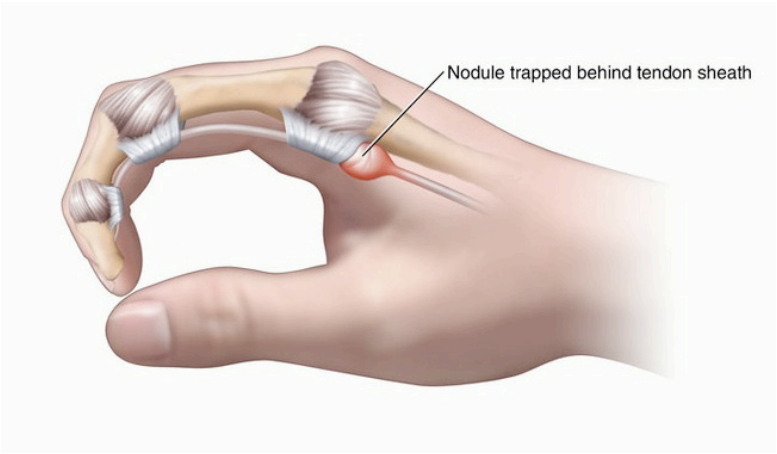
This condition involves the abductor pollicis longus and extensor pollicis brevis tendons at the radial side of the wrist and involves a stenosing tenosynovitis. De Quervain's disease usually occurs with repetitive use of the thumb, particularly involving gripping.



(Adapted from: www.handtherapy.com.au/)

Trigger Finger (Digital Flexor Tenosynovitis)

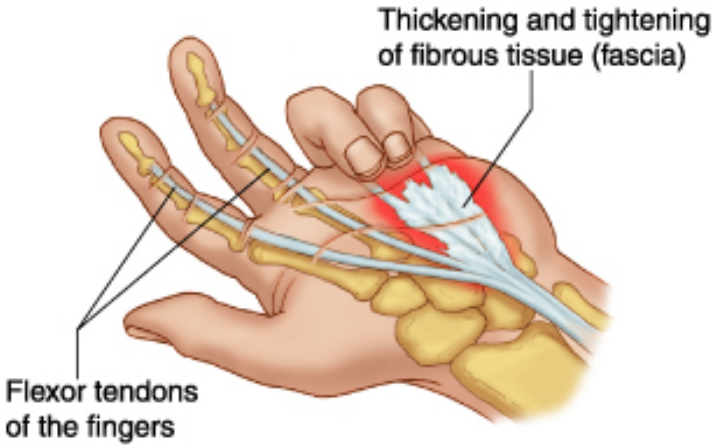
This condition affects the flexor tendons of the hand and involves a thickening or a nodule on the tendon. The classic symptoms of trigger finger occur when the tendon cannot easily glide within its sheath as the thickening or nodule catches at the site of the first annular pulley, preventing smooth extension or flexion of the finger. Patients complain of catching or locking and discomfort with grasping activity of the hand. Risk factors for this condition include rheumatoid arthritis, diabetes mellitus, or secondary to repetitive overuse.



(Adapted from : www.eliteplasticsurgeryaz.com)

Dupuytren's disease

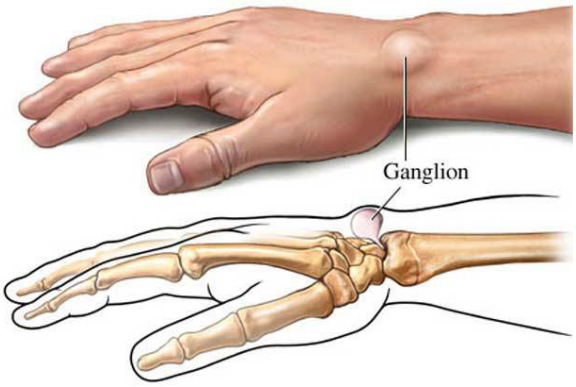
Dupuytren's disease is a fibroproliferative disorder of the palm which is common in adults over 55 years of age (Lanting et al., 2014). This disease leads to significant functional impairment, first presenting as hard nodules, before developing into cords which mature into digital contractures, becoming progressive flexion deformities in the digits (Rombouts et al., 1989). Surgery is the most common treatment for end-stage Dupuytren's disease; however non-surgical interventions such as steroid injections have been recommended early to prevent disease progression.



(From: www.mdguidelines.com/dupuytrens-contracture)

Ganglion cysts

Ganglia are cystic structures found near or attached to tendon sheaths and joint capsules. They are filled with soft, gelatinous, sticky, and mucoid fluid. The dorsal wrist ganglion is the most common site for a ganglion cyst, making up 65 percent of ganglia of the wrist and hand, and arises from the scapholunate joint. The volar wrist ganglion is the next most common, presenting as up to 25 percent of all ganglia, and arises from the distal aspect of the radius. The remaining 10-15 percent of ganglia are the flexor tendon sheath ganglia. Ganglion cysts usually develop spontaneously in adults 20 to 50 years of age, with a female-to-male preponderance of 3:1.



(Adapted from: www.weeklyhealthylife.com)

Steroids - Rationale

Locally, steroids act to inhibit the inflammatory response induced by mechanical, chemical or immunologic agents. This inhibition occurs in specific leukocyte functions, including leukocyte aggregation at inflammatory sites, prevention of degranulation of granulocytes, mast cells, and macrophages, and stabilization of lysosomal and other membranes (Di Rosa et al., 1986). Steroids also inhibit PLA2 activity, therefore interrupting the arachidonic acid cascade. It has also been shown that local application of cortisone blocks transmission in normal nociceptive C-fibres, potentially blocking nociceptive nerves in the manner of local anaesthetics.

Several different steroid preparations may be used, with or without local anaesthetic or normal saline to increase the volume of the injectate. Typical steroids used include methylprednisolone acetate, betamethasone acetate/propionate, and triamcinolone acetate. The benefits of adding a local anaesthetic include potential immediate pain relief for the patient, which provides feedback to the practitioner that the steroid solution is near the presumed site of pathology.

2. Methodology

2.1 Review question

What is the effectiveness of injection of steroid with or without local anaesthetic in patients with hand pain?

2.2 Methods

A systematic review of published research literature was undertaken to provide a synthesis of the currently available research evidence related to the effectiveness of steroid injections in patients with pain in the hand as a form of interventional pain management. A systematic and rigorous search strategy was developed to locate all published and accessible research evidence. The evidence base for this review included research evidence from existing systematic reviews, meta-analyses, and high-level primary research (randomised controlled trials, prospective cohort studies). Where no systematic reviews, randomised controlled trials, or prospective cohort studies were located, then other primary study designs (excluding commentary /expert opinion) were considered.

2.3 Search strategy

The search was developed using a standard PICO structure (shown in Table 1). Only published English language articles using human participants and accessible in full text were included.

Table 1: Criteria for considering studies in the review

Population	Humans
Intervention	Steroid injection with or without local anaesthetic for patients with hand pain as a form of interventional pain management
Comparator	Any active treatment or placebo.
Outcomes	• Pain-related primary outcome • Functional outcomes (range of motion, reduction of disability, return to work, quality of life) • Safety and risk • Relationship to imaging • Best practice recommendations • Cost effectiveness

A combination of search terms (shown in Table 2) were used to identify and retrieve articles in the following databases:

- OVID
  - EMBASE,
  - MEDLINE,
  - AMED,
- ICONDA,
- CINAHL,
- PubMed,
- Pre-Medline,
- The Cochrane Library,
- Scopus,
- TRIP database

Table 2: Search terms for the review

Search term 1	Search terms 2	Search terms 2	Search terms 3
• Pain	• Injections .	• Hand • First carpometacarpal Joint, • de Quervain's disease, • Trigger finger • Digital flexor tenosynovitis • Ganglion cysts • Digit • Fingers • Metacarpals	• Steroid • Betamethasone • Dexamethasone • Fluocortolone • Methylprednisolone • Paramethasone • Prednisolone • Prednisone • Triamcinolone • Hydrocortisone • Cortisone • Methandrostenolone • Stanozolol • Methenolone • Oxymetholone • Oxandrolone • Nandrolone • Diflucortolone • Fluprednisolone

The titles and abstracts identified from the above search strategy were assessed for eligibility by the *i*CAHE researchers. Full-text copies of eligible articles were retrieved for full examination. Reference lists of included full-text articles were searched for relevant literature not located through database searching.

2.4 Study Selection

Inclusion Criteria

- Study types: systematic reviews (SRs), all primary research designs - randomised controlled trials (RCTs), cohort studies (prospective or retrospective), case studies or case series.
- Participants: patients with pain in the hand.
- Intervention: steroid injections with or without local anaesthetic
- Controls: any active treatment or placebo, or no intervention control
- Outcomes: pain relief (primary), functional outcomes, safety, and risk (secondary)
- Publication criteria: English language, full text available, in peer reviewed journal

Exclusion Criteria

- Studies only available in abstract form e.g. conference presentations
- Grey literature and non-English language material
- Studies involving healthy volunteers or experimentally induced pain

2.5 Critical Appraisal

The Scottish Intercollegiate Guidelines Network (SIGN) checklists specific to the study design of included studies were used to assess their methodological quality. The SIGN checklists ask a number of questions with yes, no, can't say or not applicable as responses. The appraiser gives an overall rating of quality, based on the responses to

	questions, of either high quality (++), acceptable quality (+), low quality (-) or unacceptable. As there is no SIGN checklist for case studies, these study designs were not quality scored.
2.6 **Data Extraction**	Data was extracted from the identified studies using a data extraction tool which was specifically developed for this review. The following information was extracted from individual studies: • Evidence source (author, date, country) • Level of evidence • Characteristics of participants • Interventions • Outcome measures • Results For this review the studies that met the inclusion criteria were assessed for internal validity using the appropriate SIGN checklist, as outlined above. Each study was graded for overall methodological quality using the SIGN levels of evidence model.

2.7 Data Synthesis

As described, for this review each study was graded for overall methodological quality using the SIGN checklist specific to its study design.

Recommendations from the literature were made and scored according to a modification of the SIGN Evidence Grading matrix (see Table 3). The modification was to add levels 1 and 2 to differentiate between the 1+ and 1-, and 2+ and 2- levels of evidence.

Table 3: Modified SIGN Evidence Grading Matrix

Levels of scientific evidence	
1++	High-quality meta-analyses, high-quality systematic reviews of clinical trials with very little risk of bias
1+	Well-conducted meta-analyses, systematic review of clinical trials or well-conducted clinical trials with low risk of bias
1	Meta-analyses, systematic review of clinical trials or clinical trials with a moderate (acceptable) level risk of bias.
1-	Meta-analyses, systematic reviews of clinical trials or clinical trials with high risk of bias.
2++	High-quality systematic reviews of cohort or case and control studies; cohort or case and control studies with very low risk of bias and high probability of establishing a causal relationship
2+	Well-conducted cohort or case and control studies with low risk of bias and moderate probability of establishing a causal relationship
2	Cohort or case and control studies with moderate risk of bias and potential risk that the relationship is not causal
2-	Cohort or case and control studies with high risk of bias and significant risk that the relationship is not causal
3	Non-analytical studies, such as case reports and case series.
4	Expert opinion.

To standardise the strengths of recommendations from the extensive literature used for this review, a structured system was developed to incorporate a number of quality measures. Four measures were selected as important variables for the assessment of strength of recommendations from the primary and secondary research sources. These were:

a) Combination of data via meta-analysis

b) Quality of systematic review/trials

c) Number of RCTs

d) Consistency of the evidence

A scoring system was developed, based on a 0 and 1 score for each of these variables:

1. Combination of data via meta-analysis: Yes = 1, No = 0
2. Quality of systematic review: HQ/AQ (+) =1, LQ(0)/R = 0
3. Number of RCTs: ≥ 5RCTs = 1, < 5=0
4. Consistency: ≥ 75% agreement = 1, < 75% agreement = 0

This allowed for a maximum potential score of 4 and a minimum score of 0, which reflected a measure of the evidence strength across a range of studies. The resultant score was transferred to the SIGN Evidence Grading matrix

Total Score	SIGN Evidence Grading matrix score
4	1++
3	1+
2	1
1/0	1-

2.8 Grade of Recommendations

Recommendations were graded according to the Scottish Intercollegiate Guidelines network (SIGN) Grades of Recommendations (Table 4).

Table 4: Scottish Intercollegiate Guidelines network (SIGN) Grades of Recommendations

Grades of Recommendations	
A	At least one meta-analysis, systematic review or clinical trial classified as 1++ and directly applicable to the target population of the guideline, or a volume of scientific evidence comprising studies classified as 1+ and which are highly consistent with each other.
B	A body of scientific evidence comprising studies classified as 2++, directly applicable to the target population of the guideline and highly consistent with each other, or scientific evidence extrapolated from studies classified as 1++ or 1+.
C	A body of scientific evidence comprising studies classified as 2+, directly applicable to the target population of the guideline and highly consistent with each other, or scientific evidence extrapolated from studies classified as 2++.
D	Level 3 or 4 scientific evidence, or scientific evidence extrapolated from studies classified as 2+

3. Results

3.1 Evidence Sources

The search yielded 2,316 articles; following removal of duplicates, 1,465 articles were identified for screening of title and abstract. After scrutiny, 1,417 articles were excluded for failing to meet the inclusion criteria (shown in Figure 1), leaving 48 studies for inclusion in this review. Figure 1 illustrates the process involved in study selection.

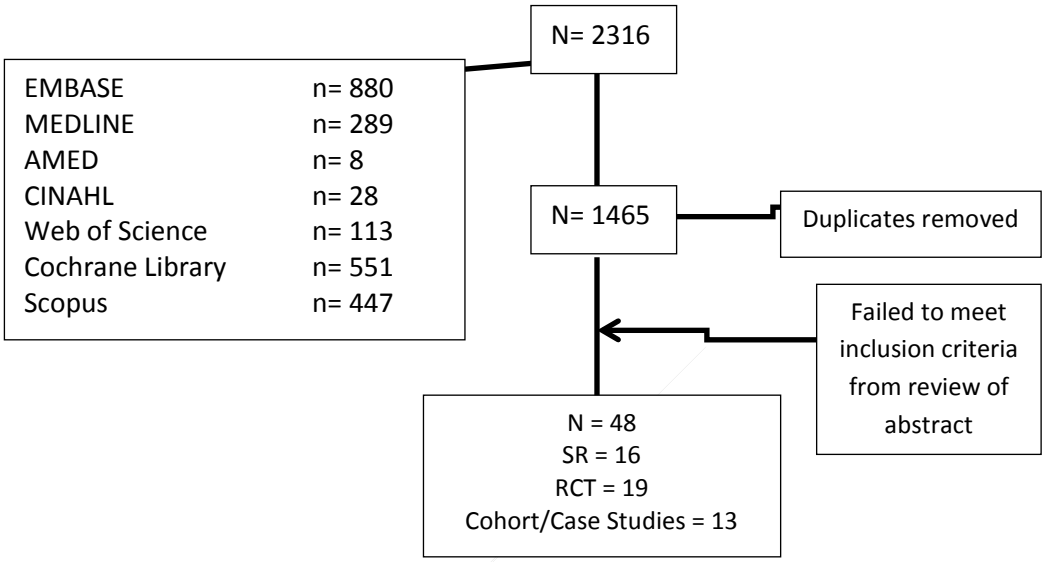


Figure 1: Flow chart of search results

3.2 Quality of the Evidence

The overall quality of the studies included in this review ranged from high quality to low quality.

	N=	HQ(++)	AQ(+)	LQ(-)	R(0)
Systematic reviews	16	6	3	7	0
RCTs	19	6	5	8	0

Appendices 2 and 3 present the critical appraisal scores for the systematic reviews and randomised controlled trials included in this review.

Issues affecting the methodological quality of the studies included the following.

Systematic reviews

A) Studies did not address the potential for publication bias in reporting their reviews.

B) Conflicts of interest were often not identified or reported.

C) Excluded studies were not listed.

D) Reviews often failed to differentiate between primary and secondary outcomes when synthesising their findings. Most systematic reviews used pain as a primary outcome and functional disability etc. as secondary outcomes, but failed to differentiate between the two when synthesising the study findings.

E) Reviews often failed to differentiate studies by dosage parameters or examine specific clinical indications reflecting better outcomes.

Randomised controlled trials

A) The studies often failed to ensure that the only difference between the two groups (intervention vs control) was the treatment under investigation. With the small numbers reported in the RCTs it was difficult to ensure that the effect of confounders was dealt with. This was particularly important when considering the effect of secondary outcomes.

B) A number of studies failed to report the use of intention to treat analysis when reporting their findings.

C) Subjects and investigators were rarely blinded to the intervention involved.

D) Studies rarely controlled for the patients' involvement in co-interventions such as exercise/medication etc.

3.3 Findings – Pain and Function

Systematic reviews

Sixteen systematic reviews were identified that investigated the effectiveness of steroid injections in the hand as a pain management intervention. These systematic reviews in turn appraised a total of 19 RCTs.

Appendices 2 and 3 outline the quality scores and findings of the systematic reviews. Appendix 4 lists the RCTs included in the systematic reviews.

Randomised controlled trials

This review identified an additional 19 RCTs that were not included in the 16 systematic reviews mentioned above. Appendices 5 and 6 outline the quality scores and findings from these additional RCTs.

3.4
Outcome Measures – Pain and Function

This review took a pragmatic approach to the presentation of the literature related to the use of steroid injections for pain in the hand, sub-dividing the studies into the most common major clinical presentations reported in the literature. For the hand these were identified as first carpometacarpal joint, de Quervain's disease, trigger finger (digital flexor tenosynovitis), Dupuytren's disease, and ganglion cysts. Where systematic reviews reported studies involving a range of pathologies, if possible the data for each pathology was extracted from the individual reviews and presented separately below.

First Carpometacarpal Joint

Systematic reviews

Peterson & Hodler (2010) performed a systematic review to address the best available evidence for the effectiveness of injection therapy for musculoskeletal conditions involving peripheral joints. This review covered multiple joints with one being the first carpometacarpal joint, for which they identified two studies which compared steroid injection with hyaluronic acid (Stahl et al., 2005, Fuches et al., 2006). Both studies reported that steroid injection resulted in faster onset of relief; however, the effect was short-term. After six months, patients having a steroid injection reported a VAS score decrease of 22.6% compared to a decrease of 56% in patients who had a hyaluronic acid injection. Hyaluronic acid also had slight to moderate superiority over steroid injections in most clinical assessment parameters (key grip strength, pulp pinch power, radial abduction etc).

Study	QS	Conclusions	Level of Evidence
Peterson & Hodler, 2010	LQ(-)	Based on two RCTs, steroid provided faster short term pain relief but viscosupplementation was superior at 6 months follow up (VAS score decrease of 56% at 26 weeks for hyaluronic acid compared to 22.6% in CSI)	1-

Kloppenburg (2005) completed a review into nonpharmacological vs pharmacological treatments for hand osteoarthritis, of which intra-articular steroid injections at the thumb base joint (first carpometacarpal joint) were investigated. Two studies were identified for steroid injection into the thumb base joint (Meenagh et al., 2004, Heyworth et al., 2008) plus one study involving preliminary data from a placebo controlled trial (Mandl et al., 2012). There was no significant effect reported for any of the studies for intervention over placebo at four, 12 or 26 weeks for pain, although one of the studies was under-powered (Meenagh et al., 2004). While Mandl et al., (2012)'s final data was not available at the time of review, no efficacy of intervention over placebo was found in the preliminary data. Due to the limited number of studies, and the fact that one study involved preliminary data, Kloggenburg et al., (2005) concluded that there was insufficient data to comment on the efficacy of intra-articular steroid injections for patients with first carpometacarpal joint osteoarthritis.

Study	QS	Conclusions	Level of Evidence
Kloppenburg	LQ(-)	Insufficient data exists to conclude on the efficacy of intra-	1-

2014		articular steroid injection for patients with thumb base OA	

Spaans et al., (2015) provided a systematic review of conservative treatment of first carpometacarpal joint osteoarthritis, identifying twenty-three articles in total. A section of this review examined intra-articular steroid injections versus hyaluronate injections. It identified seven RCTs for intra-articular injections, five of which utilised intra-articular corticosteroid injections at the first carpometacarpal joint (Meenagh et al., 2004, Stahl et al., 2005, Fuchs et al., 2006, Heyworth et al., 2008, Bahadir et al., 2009). Two studies (Roux et al., 2007, Ayhan et al., 2009) examined hyaluronic acid vs. placebo, and did not involve steroids. The methodological quality of the included studies was not examined, nor were results combined in a meta-analysis.

One study (Meenagh et al., 2004) reported on steroid injections vs. placebo, finding no significant effect differences between intervention and placebo.

Three studies (Stahl et al., 2005, Fuchs et al., 2006, Bahadir et al., 2009) compared steroid injections with hyaluronate injections. Bahadir et al., (2009) found significant pain reduction for the steroid group for a twelve-month period compared to only a six-month period for the hyaluronate group and concluded that steroids were more effective. Stahl et al., (2005) and Fuchs et al., (2006) found effectiveness for both the steroid group and hyaluronate group. However, converse to Bahadir et al., (2009), both studies reported that the hyaluronate group showed a superior effect beyond six months, while steroid was only effective for up to four weeks, concluding that hyaluronate was more effective.

One study (Heyworth et al., 2008) reported on steroid injection vs. hyaluronate injection vs. placebo, finding all groups had a decrease in pain. However, the hyaluronate group experienced fewer pain symptoms up to 26 weeks, while the placebo and steroid groups experienced less pain for up to four weeks.

Based on this evidence, Spaans et al., (2015) concluded that while there was some evidence to support intra-articular steroid injection of the first carpometacarpal joint for thumb base osteoarthritis, hyaluronate injection was more effective in the long-term.

Study	QS	Conclusions	Level of Evidence
Spaans et al., 2015	LQ(-)	Some evidence for pain relief from intra-articular steroid injection for patients with trapeziometacarpal joint OA in the short term	1
		Injection of hyaluronate injections more effective than steroid injection with longer-lasting effect	1

Trellu et al., (2015) reported a systematic review and meta-analysis which focussed on the effectiveness of intra-articular injections for thumb osteoarthritis. This review utilised a thorough search strategy, including clinical trial registries, and limited the evidence to controlled trials.

Two forms of intra-articular injections were investigated –steroid and hyaluronic acid. This review identified nine studies, of which seven studies utilised steroid injections

(Meenagh et al., 2004, Stahl et al., 2005, Fuchs et al., 2006, Heyworth et al., 2008, Bahadir et al., 2009, Mandl et al., 2012, Monfort et al., 2014).

The review concluded that hyaluronic acid may be more useful for increasing functional capacity, while steroids were more useful at reducing pain, at 24 weeks; however, there was no recorded difference for pain for steroid or hyaluronic acid compared to placebo at 12 weeks. Heterogeneity was high for the included studies (I^2= 85%-95% for pain, 34% - 95% for functional capacity, and 0% to 82% for pulp pinch force status), which made the pooling of results difficult.

Whilst there was a conclusion reached for hyaluronic acid vs steroids on pain at 24 weeks (standardized response mean (SRM) 1.44 [0.14; 2.74]), the results were driven by one strongly positive study (*n* = 40) (Bahadir et al., 2009), while three other studies found no effect for steroids at 24 weeks (*n* = 274) (Mandl et al., 2012, Monfort et al., 2014, Stahl et al., 2005). This limited the ability to draw solid conclusions from this review.

Study	QS	Conclusions	Level of Evidence
Trellu et al., 2015	AQ(+)	Steroid injections was no different to placebo at 12 weeks and at 24 weeks (SRM −1.20 [−3.69; 1.29] for pain	1
		Hyaluronic acid may be more effective than steroid injections in improving pulp pinch force (SRM −1.66 [−0.75; −2.57] by week 24.	1+
		Steroid injections may be more effective than hyaluronic acid in reducing pain (SRM 1.44 [0.14; 2.74]) by week 24	1+

Randomised Controlled Trials

Two RCTs, that were not included in the previously reported SRs, were identified that investigated the effectiveness of steroid injections for the first carpometacarpal joint.

Makarawung et al., (2013) randomised patients with trapeziometacarpal (TMC) arthrosis or de Quervain's syndrome to receive either a steroid injection (1ml, 4mg dexamethasone mixed with 1ml 1% lidocaine) or a placebo injection (2ml 1% lidocaine). They aimed to test the null hypothesis that injection type was not a predictor of upper limb disability as measured with the Disability of Arm, Shoulder and Hand (DASH) questionnaire. Of the 36 participants enrolled, 14 patients had TMC arthrosis.

Patients completed demographic data and questionnaires assessing upper limb specific disability (DASH questionnaire), pain intensity (VAS), depressive symptoms (CES-D), pain catastrophizing (PCS), and patient's health-related beliefs (MHLC), along with grip strength (Jamar dynamometer) and pinch strength (pinch gauge) measurements, at the time of injection. They completed DASH questionnaires, VAS, and treatment satisfaction questionnaires, along with grip and pinch strength measurements, at follow-up between 0.79 – 2.5 months (average 1.4 months). The primary outcome was disability, measured by DASH questionnaire, and the secondary outcome was pain intensity, as measured by VAS, at baseline and at 1 to 3 months after enrolment.

It was found that type of injection was not a predictor of upper limb disability or pain intensity at 1 to 3 months after enrolment. Pain catastrophizing explained 18% variability for upper limb disability and 33% of pain intensity variability, and was the better predictor of upper limb disability and pain intensity than injection type at 1 to 3 months after an injection.

Study	QS	Conclusions
Makarawung et al., 2013	AQ(+)	Catastrophic thinking was a better predictor of both of upper limb disability and pain intensity than type of injection (steroid vs. placebo) 1 to 3 months after an injection

Jahangiri et al., (2014) performed a RCT which compared hypertonic dextrose injection to steroid injections for osteoarthritis in the first carpometacarpal joint. The double-blind trial randomised 60 patients evenly into either the steroid group (who received three injections over three months, consisting of two saline placebo injections followed by a single injection of 40mg methylprednisolone acetate with 0.5ml 2% lidocaine) or the dextrose group (who received 20% hypertonic dextrose with 0.5ml 2% lidocaine repeated monthly for 3 months). Primary outcomes were pain on pressure (recorded using a VAS), via Fischer's pressure algometer. Secondary outcomes were pain on joint movement as recorded by VAS, hand function as measured by the Health Assessment Questionnaire – Disability Index (HAQ – Disability Index); and pinch strength as measured by a hydraulic pinch gauge. All outcomes were assessed at baseline, 1, 2 and 6 months.

At baseline and two months the primary outcome of pain on pressure was comparable between groups. Steroid injection had a lower mean VAS score than dextrose injection at one month (p=0.001); however, at six months dextrose injection had a lower mean VAS score than steroid injection (p=0.001). For secondary outcomes both steroid injection (CSI) and dextrose injection (DX) were significantly better compared to baseline at six months for pain on movement (Mean Difference (MD) DX: 3.8 (2.9, 4.8); CSI: 0.5 (0.3, 0.7)), pinching (MD strength (lbs) : DX: -2.6 (-3.9, -1.2) ; CSI: -0.9 (-1.5, -0.5)) and hand function (MD HAQ score: DX: 2.8 (2.2, 3.5) ; CSI: 1.5 (1.0,1.9)). The between-group analysis revealed that pain on movement was significantly better for the dextrose group than steroid group at 2 months (1.0, 95% CI: 0.1, 2.0) and 6 months (1.1, 95% CI: 0.2, 2.0), and hand function at 2 months (1.0, 95% CI: 0.2, 1.9) and 6 months (1.0, 95% CI: 0.2, 1.8).

The authors concluded that while the treatments are comparable in the short term, the long term pain reduction for the dextrose injection made it a more favourable treatment.

Study	QS	Conclusions
Jahangiri et al., 2014	HQ(++)	For the long term, hypertonic dextrose seems to be more advantageous, while the two treatments were comparable in the short term. Because of the satisfactory pain relief and restoring of function, hypertonic dextrose prolotherapy is preferred over steroid for the treatment of patients with OA

de Quervain's disease (stenosing tenosynovitis)

Systematic reviews

Richie & Briner (2003) conducted a pooled quantitative literature evaluation on the efficacy of steroid injections for the treatment of de Quervain's tenosynovitis. This review included studies that defined the diagnosis and successful treatment of de Quervain's and evaluated or compared treatment options among patients. Seven prospective cohort studies were included in the efficacy analysis (Christie 1955, McKenzie 1972, Harvey et al., 1990, Anderson et al., 1991, Witt et al., 1991, Weiss et al., 1994, Zingas et al., 1998). None of the seven studies utilised a control group, and all were descriptive, with successful treatment defined as the 'absence of diagnostic criteria'. The diagnostic criteria for all seven studies were: pain at radial wrist, tender over 1st dorsal compartment, and pain on the Finkelstein's test. The studies involved steroid injection alone (n = 226), or with splinting (n = 101); thumb spica splint without injection (n = 76); NSAIDs without injection (n = 39); and rest without injection (n = 17).

Richie & Briner (2003) found that there was an 83% 'cure' rate ('cure' being the complete absence of diagnostic criteria) for injections alone, which was higher than for any other treatment modality including injection and splinting in combination (61% cure rate), splint alone (14% cure rate) and 0% cure rate for rest or NSAIDS. The authors concluded that injections alone appeared to be the most effective treatment method for de Quervain's tenosynovitis.

Study	QS	Conclusions	Level of Evidence
Richie & Briner 2003	LQ(-)	83% 'cure' (absence of diagnostic criteria) rate for injection alone vs injection with splinting (61%), splint alone (14%), or rest (0%)	1-
		Injection alone appears most effective for de Quervain's disease	1-

Coldham (2006) presented a review examining the clinical evidence for splinting in the non-surgical treatment of de Quervain's disease. All study types were included due to the limited literature available. The review included one RCT (Avic et al., 2002), two prospective cohort studies (Witt et al., 1991, Weiss et al., 1994), and two retrospective trials (Johnson 1991, Lane et al., 2001), all of which utilised steroid injections either in combination with, or as a comparator to, splinting.

The authors concluded that splinting was an effective intervention for patients who had less severe symptoms, or who were in the early stages of the disease. However, steroid injections were more effective than splinting across all stages of the disease, including severe symptoms. However, the methodological quality of the included studies was low, and the authors urged caution on result interpretation due to this.

Study	QS	Conclusions	Level of Evidence
Coldham 2006	AQ(+)	Steroid injections were more effective than splinting, especially with more severe symptoms	1-

van Middelkoop et al., (2009) conducted a systematic review on the effectiveness of interventions for specific musculoskeletal disorders of the hand, including de Quervain's disease. A narrow search strategy was utilised by the authors, covering only one database (PubMed). The review found two RCTs which examined the effectiveness of steroid injection for de Quervain's disease (Avic et al., 2002, Jirarattanaphochai et al., 2004). No statistical analyses were applied due to the differences in the studies, and the studies were narratively described.

The review reported that, based on the two included RCTs, there was no evidence that NSAIDs in addition to a steroid injection were more effective than the injection alone, and that there was no evidence of symptom reduction for cortisone injection compared with splinting in pregnant patients or breast-feeding mothers.

Study	QS	Conclusions	Level of Evidence
van Middelkoop et al., 2009	AQ(+)	No clear differences between steroid injection and splinting	1-
		No efficacy of Nimesulide (NSAID) as addition to steroid injection	1-

Peterson & Hodler (2010) performed a systematic review to evaluate the best available evidence on the effectiveness of injection therapy for musculoskeletal disorders involving peripheral joints. This review covered multiple disorders with one being de Quervain's disease. The review included one literature evaluation (Richie & Briner 2003) and two RCTs that compared steroid injections alone against steroid injections in combination with another treatment therapy (Jirarattanaphochai et al., 2004, Goldfarb et al., 2007).

The review found that the addition of NSAIDs, splinting, rest or additional drug therapies conferred no benefit over steroid injections alone, based on the included literature review and two RCTs. It concluded that steroid injections alone appeared to be the superior treatment option (the RCTs found that up to 68% of patients reported substantial improvement, with 95% of patients improved at the 1 year follow-up, and the literature review found an 85% cure rate for steroids alone).

Study	QS	Conclusions	Level of Evidence
Peterson & Hodler, 2010	LQ(-)	Steroid injections alone appear to be the superior treatment	1-

Peters-Veluthamaningal et al., (2009) performed a Cochrane systematic review to summarise the evidence for the efficacy and safety of steroid injections for de Quervain's tenosynovitis. The authors utilized a broad search strategy, including clinical trial registries, and limited the evidence to controlled trials. The review included one RCT (Avci et al., 2002) which examined participants with de Quervain's disease and compared steroid injections with splinting in breast-feeding mothers.

Within Avci et al., (2002), all participants within the steroid group reported complete pain relief at six days post intervention, while none of the splinting group reported pain

relief. This RCT utilised only 18 participants and was of poor methodological quality.

Peters-Veluthamaningal et al., (2009) concluded that steroid injections were more effective than splinting based on this singular RCT, and that the applicability of this finding to clinical practice was limited based on the limited evidence.

Study	QS	Conclusions	Level of Evidence
Peters-Veluthamaningal et al., 2009	HQ(++)	All steroid injection patients experienced complete relief of pain compared to 0 patients in splinting group, up to 6 days after intervention	1-
		Steroid injection was more effective than splinting	1-

Ashraf & Devadoss (2014) presented a systematic review and meta-analysis on steroid injection therapy for de Quervain's tenosynovitis in adults. They performed a comprehensive search, limiting the evidence to RCTs which compared injections to splinting and casting. Two studies were selected for inclusion in the subsequent review and meta-analysis (Avci et al., 2002, Mehdinasab and Alemohammad 2010).

The meta-analysis concluded that steroid injection was significantly better than splinting for de Quervain's disease (Risk Ratio (RR); 3.00 [95% CI = 1.89; 4.77] p <0.01). There was moderate heterogeneity between the studies, however this was non-significant (I^2 = 64%, p > 0.05). The number-needed-to-treat (NNT) was calculated as 2; indicating that two patients needed to be treated with steroid injections for one patient to report beneficial outcomes.

The authors concluded that steroid injection was an effective form of treatment for de Quervain's disease based on two low quality RCTs, recommending further research for higher quality studies.

Study	QS	Conclusions	Level of Evidence
Ashraf & Devadoss, 2014	HQ(++)	Steroid injection is an effective form of conservative management for de Quervain's disease	1
		Steroid injection was more effective than splinting	1

Cavaleri et al., (2015) conducted a systematic review and meta-analysis of hand therapy vs steroid injections in the treatment of de Quervain's disease. Utilising a broad search strategy, the results were limited to RCTs and quasi-randomised controlled trials. This review identified six RCTs which compared hand therapy and steroid injection (Avci et al., 2002, Mehdinasab and Alemohammad 2010, Dehghan and Salehitali 2012, Hadianfard et al., 2013, Ansari 2014, Mardani-Kivi et al., 2014).

The authors concluded that the combined approach of both treatment methods was more effective than either approach alone. They reported that significantly more patients were treated successfully when hand therapies, specifically orthoses (splinting), were given alongside steroid injections (RR 2.47, [95% CI = 0.79-7.75]) than either orthoses (RR 0.53, [95% CI= 0.35-0.80]) or injections (RR 0.76, [95% CI= 0.64-0.89]) alone.

Study	QS	Conclusions	Level of Evidence
Cavaleri et al., 2015	HQ(++)	Both steroid injection and hand therapy improved pain and function from baseline (Cavaleri et al., 2015; SR HQ(++))	1++
		Steroid injection and hand therapy combined was a significantly more effective treatment than either steroid injection or hand therapy alone (Cavaleri et al., 2015; SR HQ(++))	1++

Randomised Controlled Trials

Three RCTs that were not included in the previously reported systematic reviews were identified that investigated the effectiveness of steroid injections for de Quervain's disease. One RCT (Makarawung et al., 2013) was previously reported as the authors included both de Quervain's tenosynovitis and trapeziometacarpal (TMC) arthrosis. While the pathology types differ, the results were reported without separating the pathology types. This RCT was reported again here, presenting the information relevant to de Quervain's disease not previously reported.

Peters-Veluthamaningal et al., (2009) conducted a RCT which randomised 21 patients with de Quervain's tenosynovitis to receive either a steroid injection (1ml, 10mg triamcinolonacetonide) or placebo injection (1ml, 9% NaCl). Primary outcome measures were direct treatment response one week after injection (based on consensus between the patient and their doctor), severity of pain on a NRS, functional status based on the DUTCH AIMS-2-HFF, and improvement as perceived by the participant on a 5-point scale from much worse to much better. Occurrences of adverse events were also recorded.

The steroid group reported significantly better results for short-term outcomes for direct treatment response after one week (78% vs. 25%), patient perceived improvement (78% vs. 33%), and severity of pain (4.27 vs. 1.33). There was no significant difference between treatment types for the functional status (2.71 vs. 1.92, $p = 0.112$).

The authors offered a bail-out treatment to non-responders of the placebo group (which allowed them to receive a subsequent steroid injection), and non-responders of the steroid group (which referred them to surgery treatment). For long term results, reported up to twelve months after first injection, the authors only reported on patients who responded to treatment for the steroid injection as a cohort study. While the authors reported that short-term results were maintained for severity of pain and functional status, the results at twelve months were not significant ($p = 0.67$, $p = 0.36$ respectively).

Study	QS	Conclusions
Peters-Veluthamaningal et al., 2009	HQ(++)	One or two local steroid injections lead to improvement in the short term in participants with de Quervain's tenosynovitis when compared to placebo
		The short-term beneficial effects of steroid injections for symptoms were maintained during the follow-up after 12 months, though this was non-significant

Kume et al., (2012) compared ultrasonography-guided (US) injections to manual clinical injection by randomising 44 wrists to either group. Both groups were targeting the extensor pollicis brevis (EPB) in de Quervain's disease, and received 20mg of triamcinolone and 1ml of 1% lidocaine, either with or without ultrasonography guidance. Outcome measures were pain, as recorded by a 0-100 VAS at baseline and four weeks, and number of surgeries post injection at six weeks.

After four weeks, both groups had significant pain reduction from baseline, with US injections 80.3 (SD:19.6) at baseline compared to 25.6 (SD:15.1) at four weeks ($p = 0.004$) and blinded injections 78.0 (SD:18.5) at baseline compared to 58.2 (SD:21.9) at four weeks ($p = 0.04$). From the between-group comparison the decrease in pain was significantly greater for the US injection group than the blind injection group at the four-week follow-up ($p = 0.0007$). At the six-week time point, two patients in the US group and nine in the blind injection group required surgery, with the surgery to total patient ratio significantly lower for the US group ($p <0.01$).

The authors concluded that ultrasonography-guided injections were more effective than blinded clinical injection at targeting the extensor pollicis brevis in de Quervain's disease.

Study	QS	Conclusions
Kume et al., 2012	AQ(+)	US-guided injection targeting the EPB in patients with de Quervain's is more effective than blinded injection

Makarawung et al., (2013) randomised patients with trapeziometacarpal (TMC) arthrosis or de Quervain's syndrome to receive either a steroid injection (1ml, 4mg dexamethasone mixed with 1ml 1% lidocaine) or a local anaesthetic injection (2ml 1% lidocaine). They aimed to test the null hypothesis that injection type was not a predictor of upper limb disability as measured with the Disability of Arm, Shoulder and Hand (DASH) questionnaire. Of the 36 participants enrolled, 22 patients had de Quervain's syndrome.

Patients completed demographic data and questionnaires assessing upper limb disability (DASH), pain intensity (VAS), depressive symptoms (the Center for Epidemiologic Studies-Depression Scale (CES-D)), pain catastrophizing (the Pain Catastrophizing Scale (PCS)), and patient's health-related beliefs (the general Multidimensional Health Locus of Control (MHLC)), along with grip strength (Jamar dynamometer) and pinch strength (pinch gauge) measurements, at the time of injection. They completed upper limb disability, pain, and treatment satisfaction questionnaires, along with grip and pinch strength measurements, at follow-up between 0.79 – 2.5 months (average 1.4 months). The primary outcome was upper limb disability, and the secondary outcome measure was pain intensity, measured at baseline and 1 to 3 months after enrolment.

It was found that type of injection was not a predictor of arm-specific disability or pain intensity at 1 to 3 months after enrolment. There was no difference in upper limb

disability or pain intensity after steroid or placebo injection. Pain catastrophizing explained 18% variability for upper limb disability and 33% for pain intensity, and was the better predictor of upper limb disability and pain intensity than injection type at 1 to 3 months after an injection.

Study	QS	Conclusions
Makarawung et al., 2013	AQ(+)	Catastrophic thinking was a better predictor of both of arm-specific disability and pain intensity than type of injection (steroid vs. placebo) 1 to 3 months after an injection

Trigger finger (digital flexor tenosynovitis)

Systematic Reviews

Akhtar & Burke (2006) performed a review of the efficacy of steroid injection for trigger finger and thumb alongside illustrative techniques for injection. The review included six studies of low quality, including three prospective cohort studies (Rhodes et al., 1984, Marks et al., 1989, Anderson et al., 1991) and three retrospective cohort studies (Clark et al., 1973, Newport et al., 1990, Benson et al., 1997). The review examined only the 'cure' rate, i.e. the complete absence of diagnostic symptoms, of each study to determine efficacy and these results were not collated.

The authors found that the cure rate after one treatment ranged between 49% and 84%, and the cure rate after more than one treatment ranged between 72% and 93% across the cohorts. Follow-up for the included studies ranged from 18 months to 55 months, and all of the included studies were performed before 1992. No statistical analysis was performed on the results.

The authors included methods for identifying superficial landmarks of the A1 pulley, and presented two techniques for steroid injection into the flexor sheath beyond their literary review. They concluded that steroid injection in the flexor sheath was an effective method of treating patients with trigger finger, recommending it as the preferred treatment.

Study	QS	Conclusions	Level of Evidence
Akhtar & Burke, 2006	LQ(-)	Steroid injection in the flexor sheath at the level of the A1 pulley is an effective method of treating patients with trigger finger	1-

Fleisch et al., (2007) performed a systematic review of steroid injections for the treatment of trigger finger, including only RCTs so as to determine effectiveness of the injection. A satisfactorily broad search method was utilised. Four RCTs (Lambert et al., 1992, Murphy et al., 1995, Taras et al., 1998, Maneerit et al., 2003) were included that met the inclusion criteria that they were prospective RCTs of adults with at least 85% follow-up achieved.

The authors extracted information relevant to study design and results of the studies to determine effectiveness. They determined that the outcome measures utilized by the RCTs were too variable to provide a consistent evaluation, and that studies lacked a uniform scale of determining resolution for trigger finger, and inconsistently measured pain, not allowing for comparison between studies. Despite this, the included studies consistently reported significant reduction in pain compared to placebo (Lambert et al., 1992 ($p<0.05$), Murphy et al., 1995 ($p<0.02$), Maneerit et al., 2003 ($p=0.001$)), averaging a 44% difference in number of successful patients in favour of steroid injection when compared to placebo.

The authors concluded that steroid injection provided relief for trigger finger in 57% of patients, which contrasted to other systematic reviews which report closer to 87% effectiveness (Lambert et al., 1992; Murphy et al., 1995; Maneerit et al., 2003).

Study	QS	Conclusions	Level of Evidence
Fleisch et al., 2007	LQ(-)	Steroid injection provided relief in 57% of patients with trigger finger	1-

Peters-Veluthamaningal et al., (2009) performed a Cochrane systematic review examining the effectiveness of steroid injections for trigger finger in adults. Utilising a broad search strategy, the results were limited to RCTs and quasi-randomised controlled trials. Two small, low quality studies (Lambert et al., 1992, Murphy et al., 1995) were included. These studies included 63 participants and compared steroid injections in combination with lidocaine to placebo injections of lidocaine alone.

The results indicated that steroid injection with lidocaine was more effective than lidocaine alone for treatment success (the resolution of symptoms) at four weeks (relative risk (RR) = 3.15, 95% CI 1.34 to 7.40). One study followed patients for four months, and found the effects of steroid injection were still present, with 64% (9/14) patients without symptoms after steroid injection compared to 20% (2/10) for lidocaine alone (Murphy et al., 1995).

The authors concluded that while the results showed that steroid injection with lidocaine was more effective than placebo, they acknowledged the low quality and small sample size of included studies, and recommended further trials investigating steroid injection for trigger finger.

Study	QS	Conclusions	Level of Evidence
Peters-Veluthamaningal et al., 2009	HQ(++)	Steroid injection with lidocaine was more effective than lidocaine alone on treatment success at 4 wks	1
		Short-term effects recorded for combination, 1 study showed steroid effects last up to 4 months	1

Randomised Controlled Trials

Fourteen additional RCTs, not included in the previously reported SRs, were identified that investigated the effectiveness of steroid injections for trigger finger. For this analysis we have reviewed the effectiveness of the steroid injections against baseline measures, other interventions, and by technique type.

Steroid injection compared to baseline

This analysis of the additional RCTs identified whether the use of steroid resulted in changes in the outcome measures from baseline:

Study	QS	Outcome measure	Result
Callegari et al., (2011)	LQ (-)	DASH	Pain imp. @ 6/12 (sig. not calculated)
		Pain (VAS)	Total resolution 14/15 @ 6/12; 11/15 @ 12/12
		Satisfaction (VAS)	Imp. @ 6/12 (sig. not calculated)
Cecen et al., (2015)	LQ (-)	Quinnell Grade	Sig. imp. @ 6/52 & 6/12
		Pain (VAS)	Sig. imp. @ 6/52 & 6/12
Jianmongkol et al., (2007)	LQ (-)	Pain (VAS)	Sig. imp. @ 1/52, 3/52, & 6/52
		Paracetamol count	Non sig. @ any time-point
Liu et al., (2015)	HQ (++)	Quinnell Grade	Non sig. @ 3/52 & 3/12
		Function (MHQ)	Sig imp. @ 3/52, declined at 3/12
		Pain (VAS)	Sig. imp. @ 3/52 & 3/12
		ROM (TAM)	Sig. imp @ 3/52 & 3/12
		Grip Strength (Jamar grip dynamometer)	Sig. imp. @ 3/52 & 3/12
Peters-Veluthamaningal et al., (2008)	HQ (++)	Perceived improvement	Sig. imp. @ 1/52 Non-sig. imp @ 12/12
		Frequency of triggering	Sig. imp. @ 1/52 Non-sig. imp @ 12/12
		Pain (NRS)	Sig. imp. @ 1/52 Non-sig. imp @ 12/12
		Functional status (DUTCH-AIMS-2)	Non. sig. @ 1/52 Non-sig. imp @ 12/12
Salim et al., (2012	LQ (-)	Pain (VAS)	Sig. imp. @ 6/52 & 3/12
		Frequency of triggering	Sig. imp. @ 6/52 & 3/12
		Functional status (restriction or pain during ADLs)	Non. sig. @ 6/52 & 3/12
		Grip Strength (Jamar grip dynamometer)	Sig. imp. @ 6/52 & 3/12
Shakeel & Ahmad (2012)	LQ (-)	Quinnell Grade	Sig. imp. @ 3/52, but not at 3/12
		Adverse events	20% patients experienced adverse events by 3/12
Yildirim et al., (2016)	HQ (++)	Pain (VAS)	Sig. imp. @ 1/12, 3/12, 6/12
		Frequency of triggering	
		Function impact of triggering (FIT)	
		Functional Satus (QuickDASH)	
		Quinnell grade	

Eight studies reported on outcomes for steroid injection compared to baseline and showed an improvement in pain score and reduction in triggering. Most studies utilised the Quinnell grade of triggering to define 'cure' as complete absence of triggering, and while most studies reported an improvement in Quinnell grade, most were non-significant. The effect of steroid injection appeared more prominent during the short-term, and was maintained during long-term (6-12 month) follow-up.

Steroid injection compared to another intervention

Nine studies compared the outcomes from a steroid injection for trigger finger with another intervention. From the studies reviewed, seven comparators were identified:

Comparator	Study	Quality Score	Results
Placebo	Peters-Veluthamaningal et al., (2008)	HQ	• Steroid injection was sig. more effective than placebo across 4/5 outcome measures: treatment response, severity of pain, perceiving improvement, and functional outcomes compared to placebo (NaCl) in the short term • Frequency of triggering was improved, but not sig.
Intra-articular steroid injection better than placebo for pain, perceived improvement, and functional outcomes.			
Percutaneous A1 Pulley Release	Sato et al., (2012)	HQ	• Percutaneous release remission of symptoms achieved in all cases over 6/12, with 0 relapses • Remission of symptoms achieved in 57% of cases at one steroid injection (12.5% relapse), and 86% for two steroid injections (delivered where needed; 18% relapse) • Steroid injection had less imp. in topical pain at 1/52 (p = 0.000), 2/52 (p = 0.000), 1/12 (p = 0.008) and articular pain at 1/52 (p = 0.014), 2/52 (p = 0.023), 1/12 (p = 0.029) than percutaneous release
	Zyluk & Jagielski (2011)	AQ	• Steroid injection greater AROM and grip strength (non-sig.) at 1/12 than PPR, maintained AROM at 6/12. • 11% steroid injections had symptoms recur by 6/12, with 0% in PPR • PPR had less pain on movement at 6/12
Percutaneous A1 pulley release better than steroid injections for remission of symptoms without relapse.			
NSAID injection	Shakeel & Ahmad (2012)	LQ	• Complete symptomatic resolution @ 3/12 70% in steroid injections vs. 53% in NSAID • Quinnell grade sig. better for steroid injections at 3/52, grade comparable to NSAID at 3/12
NSAID injection comparable for grading in long term, but has lower symptomatic resolution rates.			
Extracorporeal shock wave therapy	Yildirim et al., (2016)	HQ	• Both steroid injections and shock wave therapy showed sig. imp. For all outcome measures, including cure rate, pain (VAS), frequency of triggering, severity of triggering, functional impact of triggering and DASH results at 1/12, 3/12, & 6/12
Steroid Injections and shock wave therapy appear to be equal in effectiveness for all time-points. Extracorporeal shock wave therapy may be an alternative to steroid injection for trigger finger.			
Open surgery	Sato et al., (2012)	HQ	• Open surgery remission of symptoms achieved in all cases over 6/12, with 0 relapses • Remission of symptoms achieved in 57% of cases at one steroid injections (12.5% relapse), and 86% for two steroid injections (delivered where needed; 18% relapse) • Lower TAM results recorded for surgery at 1/12 (p = 0.012), 2/12 (p = 0.048), and 4/12 (p = 0.068). • Injection had lower imp. in topical pain at 1/52 (p = 0.000), 2/52 (p = 0.000), 1/12 (p = 0.008) and articular pain at 1/52 (p = 0.014), 2/52 (p = 0.023), 1/12 (p = 0.029) than open surgery
	Callegari et al., (2011)	LQ	• Open surgery vs steroid injections followed by HA injection; • Surgery resulted in complete symptom resolution by 3/52, without relapse @ 12/12 • Steroid injections + HA 14/15 complete resolution @ 6/12, 3/14 relapsed by 12/12.
Open surgery better than steroid injection for remission of symptoms without relapse.			
Physiotherapy	Salim et al., (2011)	LQ	• @ 3/12 absence of pain and trigger symptoms 97.4% in steroid injections and 68.6% for physiotherapy

			• Steroid injections recorded lower pain, higher satisfaction, stronger grip, return to normal function @ sig. levels ($p < 0.05$) @ 3/12 • @ 6/12, steroid injections had sig. recurrence of pain, no recurrence of triggering, where physiotherapy had no recurrence of pain or triggering
Steroid injections more effective than physiotherapy for reduction in symptoms. Physiotherapy may be useful for reducing recurrence of pain.			
Hyaluronic Acid injection	Callegari et al., (2011)	LQ	• Steroid injections utilised in combination with HA injection. • Steroid injections + HA 14/15 complete resolution @ 6/12, 3/14 relapsed by 12/12 • No major or minor complications of steroid injections + HA
	Liu et al., (2015)	HQ	• @ 3/12 steroid injections had non-sig. imp over HA for reduction of triggering (89.5% vs 66.7%) • @ 3/12 steroid injections had sig. lower VAS, while HA had sig. imp in functional disability on MHQ. • Similar Quinnell grade imp. At 3/52 & 3/12 for both groups
HA injection, especially in combination with steroid injections, may be feasible treatment for trigger finger.			
Miniscalpel-needle release	Chao et al., (2009)	LQ	• Successful percutaneous release 43/46 (93%) @ 1/12; 44/46 (96%) @12/12 for MSN release • 21/47 (45%) @ 1/12; 12/47 (26%) @12/12 for steroid injections • Mean pain scores lower for MSN release at both 1/12 (0.8 [0.6] vs 4.6 [1.8]) & 12/12 (0.4[0.3] vs 6.9 [2.6]).
Percutaneous release with a MSN release had a higher success rate than steroid injection.			

Change in outcomes from steroid injection related to technique

A number of studies have investigated the effect of differences in mechanisms of injection (e.g. use of imaging or not) and the type of the injectate. As steroid injection to the hand for trigger finger can be quite a painful option for patients, some RCTs also investigated treatment for pain of treatment injection:

	Study	QS	Results
Injectate type	Ring et al., (2008)	LQ	• No sig dif between dexamethasone & triamcinolone @ 3/12 • Rate of recurrence 8 participants for triamcinolone and 1 participant for dexamethasone • @ 6/52 absence of triggering 22/35 in triamcinolone, 12/32 dexamethasone ($p = .05$); @ 3/12, 27/41 triamcinolone vs 22/31 dexamethasone ($p = .87$)
Triamcinolone may have a faster response in the short-term, though minimal difference between two injectate types in the long-term.			
Use of Imaging	Cecen et al., (2015)	LQ	• US guided steroid injections no better than blinded steroid injections for pain or Quinnell grade for 6/52 or 6/12
Blind injection vs. US guided does not appear to have any significant additional benefit compared to blinded injections.			
Injection type	Jianmongkol et al., (2007)	LQ	• Conventional injection (CI) vs. mid-axial injection (MAI) • Pain at injection lower for MAI ($p < 0.05$); similar pain between groups were recorded at 1/52, 3/52, & 6/52 • Rate of recurrence non-sig. higher for CI group

	Pataradool & Buranapuntaruk (2011)	LQ	• Conventional injection (CI) vs. proximal phalanx injection (PPI) • Pain at injection lower for PPI (p = 0.001); long term pain effect not investigated • Rate of recurrence non-sig. higher for PPI group
Both MAI and PPI recorded less initial pain at injection than conventional CSI. MAI reported similar results to CI at 6/52, while PPI study did not examine longer term effects. MAI may serve as an alternative method to CI for steroid injection.			
Pain at injection	Sibbitt et al., (2011)	LQ	• Nerve blocks at the wrist to reduce steroid injection pain for trigger finger • Nerve block preferred before steroid injection for pain of injection (p = 0.0001) • Did not affect outcome of trigger finger resolution, but reduced pain at injection
	Park et al., (2014)	AQ	• Topical vibration before injection to reduce steroid injection pain for trigger finger • No sig. differences recorded for anticipated pain vs. actual pain for groups (p = .66; p = .48) • Vibratory stimulation does not reduce pain experienced during injection
Nerve blocks at the wrist significantly reduced pain of steroid injection for trigger finger. Topical vibration before injection did not reduce pain of steroid injection for trigger finger.			

Dupuytren's disease

Systematic reviews

Ball et al., (2016) was the only systematic review identified that investigated Dupuytren's disease. It examined non-surgical treatments for early diagnosed Dupuytren's disease, of which steroid injections represented a subset. The authors identified 26 studies, none of which were RCTs. The studies evaluated pharmacological therapy (n = 11), physical therapy (n = 5), and radiotherapy (n = 10). Of these, three case series involved steroid injections (Coste et al., 1953, Zachariae et al., 1955, Ketchum et al., 1993).

The authors concluded that steroid injections appeared to slow the progression of Dupuytren's disease while softening the hardened nodules, and therefore may be a useful conservative treatment to delay surgery. However, the evidence available was not rigorous or high quality, and true conclusions could not be reached because of this.

Study	QS	Conclusions	Level of Evidence
Ball et al., 2016	HQ(++)	• Intra-lesional steroid injection and radiotherapy appeared to lead to softening of nodules and to retard disease progression, but lacked rigorous evaluation and studies were poorly designed.	1-

Randomised Controlled Trials

This review found no further RCTs that were not included in the previously reported systematic reviews that investigated the effectiveness of steroid injections for Dupuytren's disease.

Ganglion cysts

The use of steroid for management of ganglion cysts was first recommend in 1953 (Becker 1953) and was originally introduced based on the mistaken theory that ganglia were inflammatory in origin (Meena and Gupta 2014). It has been used as an adjunct therapy, most commonly in combination with aspiration.

Systematic Reviews

Meena and Gupta (2014) completed a literature review on the evidence related to the management of wrist ganglionic cysts. Whilst this review lacked the formal methodological rigour associated with systematic reviews, it was the only review that explored the difference between the use of steroids or not. The review identified four studies that investigated the use of steroid with aspiration (Derbyshire 1966, Paul and Sochart 1997, Wright et al., 1994, Breidahl and Adler 1996).

They concluded that the results from the studies were really no better than aspiration alone, suggesting that there was limited benefit by injection of steroids at the time of aspiration.

Study	QS	Conclusions	Level of Evidence
Meena and Gupta 2014	LQ (-)	Limited benefit from injection of steroids at the time of aspiration.	1-

Head et al., (2015) presented a systematic review and meta-analysis into the effectiveness of treatments for wrist ganglion. This review combined studies that involved aspiration of the ganglion cysts with or without use of steroids into one group, affecting the ability to draw conclusions about the effectiveness of steroids. The reviewers reported that they did so because there was no difference between the use of steroids or not. This observation was based on the RCT by Varley et al., (1997).

Study	QS	Conclusions	Level of Evidence
Head et al., 2015	HQ (++)	Unable to distinguish CSI from other forms of treatment; cannot reach a conclusion relevant to this review due to this	1++

3.5
Pain and Function - Recommendations

First Carpometacarpal Joint

- **The evidence suggests that steroid injections for thumb-base osteoarthritis should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on conflicting results from one LQ SR (Spaans et al., 2015) (demonstrating short term benefit of steroid injections for pain relief), one AQ SR (Trellu et al., 2015) (demonstrating steroid injections were no more effective than to placebo up to 24 weeks) and one AQ RCT (Makarawung et al., 2013) (demonstrating catastrophic thinking was a better predictor of disability and pain intensity than type of injection up to 3 months after injection).
- **The evidence suggests that the effectiveness of steroid injection compared to hyaluronate injection for relief of pain in thumb-base osteoarthritis remains unclear.** Level B Recommendation based on conflicting results from one LQ SR (Spaans et al., 2015) demonstrating greater long term benefit of HA for pain relief, and one AQ SR (Trellu et al., 2015) demonstrating greater long term benefit of steroids for pain relief.

de Quervain's disease (stenosing tenosynovitis)

- **The evidence suggests that steroid injections are effective in reducing pain and improving function in patients with de Quervain's disease.** Level A Recommendation based on two HQ SRs (Ashraf & Devadoss 2014, Cavaleri et al., 2015) and one HQ RCT (Peters-Veluthamaningal et al., 2009).
- **The evidence suggests that steroid injections are more effective in reducing pain and improving function in patients with de Quervain's disease when combined with hand therapy.** Level B Recommendation based on one HQ SR (Cavaleri et al., 2015).

Trigger finger

- **The evidence suggests steroid injections are effective in reducing pain and improving function in patients with trigger finger compared to placebo.** Level B Recommendation based on one HQ SR (Peters-Veluthamaningal et al., 2009).
- **The evidence indicates that steroid injections are less effective than percutaneous A1 pulley release for pain and recurrence in patients with trigger finger.** Level B Recommendation based on the results from one HQ RCT (Sato et al., 2012), and one AQ RCT (Zyluk & Jagielski 2011).
- **The evidence suggests that steroid injections with lidocaine are more effective than lidocaine alone in reducing pain.** Level B Recommendation based on one HQ SR (Peters-Veluthamaningal et al., 2009).
- **The evidence suggests that steroid injections are as effective as extracorporeal shock wave therapy alone in reducing pain.** Level B recommendation based on one HQ RCT (Yildirim et al., 2016).
- **The evidence indicates that steroid injections are not as effective as open surgery for reducing pain in patients with trigger finger.** Level B recommendation based on the results from one HQ RCT (Sato et al., 2012).
- **The evidence indicates that the effectiveness of steroid injections for reducing**

pain and improving function is improved when used in combination with hyaluronate injection in patients with trigger finger. Level B recommendation based on the results from one HQ RCT (Liu et al., 2015) and one LQ RCT (Callegari et al., 2011).

Dupuytren's disease

- **The evidence suggests that steroid injections for Dupuytrens disease should not be first line of treatment as the evidence remains unclear**. Level B Recommendation based on one HQ SR (Ball et al., 2016 SR (HQ).

Ganglion cysts

- **The evidence suggests that steroid injections for ganglion cysts should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on one LQ SR (Meena and Gupta 2014 SR (LQ).

3.6 Findings – Safety and Risk

General

Overall, the rate of adverse events for steroid injections to the hand was small. Across the course of the review no serious adverse events were reported for steroid injection regardless of pathology. Minor adverse events were infrequently reported, with trigger finger reporting the highest number of minor adverse events such as pain at injection (Chao et al., 2009; Jahngiri et al., 2014), steroid rash (Jirarattanaphochai et al., 2004, Goldfarb et al., 2007, Peters-Veluthamaningal et al., 2009), and heat flushes (Peters-Veluthamaningal et al., 2008). However, it should be noted that trigger finger also represented the largest number of RCTs included in the review, and that increased reporting of events may reflect the number of included studies rather than a higher risk of minor complications. In fact, Castellanos et al.'s (2015) study into the long-term effectiveness of steroid injection for trigger finger and thumb followed 71 patients for eight years and found no complications or adverse events of any kind.

It is believed that injecting steroids mitigates the systemic effects associated with oral administration. However, transient increased blood glucose levels can still occur in diabetic patients after the injection of steroids to the hand (Stepan et al., 2014). While none of the studies examined in this review found any specific issues related to raised blood glucose levels for diabetic patients, many noted it as a concern (Akhtar & Burke 2006, Sato et al., 2012, Shakeel & Ahmad 2012). One prospective cohort study reported that 80% of patients (20/25) reported elevated blood glucose levels from baseline levels after 10 mg of triamcinolone acetonide steroid injection to the hand (Kim et al., 2015). They also found that haemoglobin A1c levels can be utilised to provide a rough predication of the degree of blood glucose elevation following steroid injection into the hand for diabetic patients, which could be utilised for future studies to examine blood glucose levels following injections for hand pain.

First carpometacarpal joint

The most common adverse event reported was pain at injection site. One systematic review noted that adverse events were most often injection-related pain, bruising, mild

skin atrophy and hypopigmentation at the injection site (Kloppenburg 2014). Of the four systematic reviews and three RCTs included in this review, the only adverse events recorded were related to injected-related pain, often noted as mild and self-resolving (Chao et al., 2009; 1/83 patients), and transient pain at the injection site which resolved without intervention (Jahngiri et al., 2014; 3/60 patients). No major or serious complications were recorded in any of the included studies.

De Quervain's tenosynovitis

Ashraf & Devadoss (2014) presented a systematic review and meta-analysis on steroid injection therapy for de Quervain's tenosynovitis in adults. It noted minimal adverse reactions to steroid injection and of those events reported, the symptoms were minor and transient. The most common adverse event was a temporary and self-resolving steroid flare reaction, which was noted in four studies (Jirarattanaphochai et al., 2004, Goldfarb et al., 2007, Peters-Veluthamaningal et al., 2009, Mehdinasab & Alemohammad 2010), affecting up to 40% of patients. Skin discolouration or hypopigmentation (lightening of the skin) occurred minimally (1-2 cases) in three studies (Harvey et al., 1990, Jirarattanaphochai et al., 2004, Mehdinasab & Alemohammad 2010). Harvey et al., (1990) reported on two cases of persistent non-tender nodule over the affected tendons post-injection. Mehdinasab & Alemobammad, (2010) also reported one case of minor transient sensory radial nerve impairment. Jirarattanaphochai et al., (2004) documented subcutaneous nodule formation and ecchymosis in few patients. McKenzie (1972) found one case of grip weakness following injection of 30 patients. Christie (1955) noted one case of superficial thrombophlebitis and two cases of post-injection pain.

Sawaizumi et al., (2007) presented a cohort study on the efficacy of steroid injection for de Quervain's tenosynovitis which reported minor complications. Four patients (4/36) reported pain at injection site after injection, though this had spontaneously resolved by follow-up examination at 2 weeks. Skin discolouration at injection site occurred for four patients (4/36), and subcutaneous fat tissue at injection site occurred for three patients (3/36); however, these had resolved without intervention by the six-month follow-up.

No RCT within this review reported any serious or minor adverse events or complications for patients regarding steroid injection for de Quervain's disease.

Trigger Finger

Akhtar & Burke (2006) presented a systematic review of the efficacy of steroid injection for trigger finger and thumb. They found transient pain at injection site was the most common complication of steroid injection. They acknowledged the possibility of other complications, including dermal or subcutaneous atrophy, hypopigmentation at injection site, infection of the flexor sheath, and rupture of the tendon, though they did not encounter these complications.

Peters-Veluthamaningal et al., (2008) conducted an RCT to examine the efficacy and safety of steroid injections for trigger finger. They found minor side effects were reported, including hot flushes in nine patients (9/50) and steroid flare in six patients (6/50).

Shakeel & Ahmad (2012) conducted an RCT which compared steroid injection to NSAIDs for the treatment of trigger finger. For the steroid group, ten patients (20%) had complications, with the most frequent complication being the recurrence of triggering for nine patients (18%). Pain at injection site was recorded for one patient (2%)

Necrotising fasciitis, a severe soft-tissue infection, has been recorded in relation to trigger finger as a very rare and unlikely complication. One case of a 55-year-old woman with swelling, skin discolouration, and pain five days after a triamcinolone and lignocaine injection for middle finger triggering was presented by Yam and colleagues in 2009 (Yam et al., 2009). The authors noted that necrotising fasciitis was rarely presented after a hand injection, and that while some swelling and pain at injection site was normal as was 'flare reaction' due to the steroid crystals (Berger and Yount 1990), persistent pain and swelling beyond 48 hours requires investigation.

Tendon rupture following steroid injection in the hand is often not considered by medical professionals due to its rarity. Lin & Shieh (2016) reported on two cases of extensor pollicis longus or brevis tendon rupture following steroid injections, one which resulted in complete severing of both tendons following three steroid injections for trigger thumb. The second case found ruptures of the extensor pollicis brevis tendon and the radial collateral ligament after a singular injection to her trigger thumb. Nanno et al., (2014) reported a rare case of flexor pollicis longus tendon rupture after two intra-sheath steroid injections for a triggered thumb. The authors noted that the partial rupture of the tendon didn't occur until after the patient underwent open surgery to release the A1 pulley following failed triamcinolone acetonide injection. In all reported examples of tendon rupture following injection, ruptures occurred at least two months after injection, with one case study reporting rupture four years post-injection.

While flexor pollicis longus tendon rupture for steroid injection for trigger finger is very unusual with only four cases reported in English (Taras et al., 1995, Fitzgerald et al., 2005, Yamada et al., 2011, Nanno et al., 2014), extensor pollicis longus tendon rupture appears slightly more common (Cigna et al., 2013). Although tendon rupture of any kind remains a rare occurrence, it is a risk of steroid injection most clearly noted in regards to trigger finger injection and therefore must be considered.

Dupuytren's disease

Ball et al., (2016) examined non-surgical treatments for early diagnosis of Dupuytren's disease, including comparing steroid injection against other treatment modalities.

Adverse events were reported for 50% of steroid injection patients, including hypopigmentation and subcutaneous atrophy at the injection site, though all events were transient and resolved without intervention within six months of injection.

Ganglion cysts

Datta and Rao (2016) presented a prospective cohort study involving 74 patients (M=28, F=43) with wrist ganglia treated with aspiration and injection with Triamcinolone (kenacort) and Hyaluronidase (hynidase). Complications included recurrence (12.1%), mild parathesia (2.7%), mild depigmentation (4%), thrombophlebitis at injection site (2.7%) and increased pain at injection site (1.35%).

Manjunatha (2016) presented a non-randomised study comparing aspiration with methylprednisolone against aspiration with loop suture technique for patients with dorsal wrist ganglions. Patients were followed up over 6 months and complications reported included recurrence (25.5%) and hypopigmentation (7.3%). It is unclear why the recurrence rate in this study was twice that reported by Datta and Rao (2016)

Rahim (2016) presented the results from a non-randomised study comparing the effects of aspiration alone, aspiration plus methylprednisone injection and aspiration plus ethanol injection into the dorsal wrist ganglions of 66 patients. They reported that that recurrence rate following aspiration plus steroid injection was 45% over 12 months.

Stapczynski (1991) presented a case study of a patient who reported localized depigmentation after local injection of triamcinolone diacetate for a ganglion cyst in the hand. The authors reviewed the literature and reported that there were so few cases reported that an incidence rate was impossible to identify. They reported that the effects were more significant in dark-skinned subjects where the hypopigmentation was more evident and that there was some experimental evidence that less potent and shorter-acting steroid preparations have a lower likelihood of depigmenting side effects.

3.7 Safety and Risk - Recommendations

First Carpometacarpal Joint

The evidence indicates that the risk of serious adverse events related to steroid injections for first carpometacarpal joint osteoarthrosis is low. The most often reported adverse events are minor and include injection-related pain, bruising, mild skin atrophy and hypopigmentation at the injection site. *Level A recommendation based on one AQ SR (Trellu et al., 2015) and three LQ SRs (Peterson & Hodler 2010, Kloppenburg 2014, Spaans et al., 2015).*

de Quervain's disease (stenosing tenosynovitis)

The evidence indicates that the risk of serious adverse events related to steroid

injections for de Quervain's disease is low. The most often reported adverse events are minor and include hypopigmentation at the injection site, persistent non-tender nodule over the affected tendons, minor transient sensory radial nerve impairment, injection-related pain, bruising, grip weakness and superficial thrombophlebitis. *Level B recommendation based on one HQ SR (Ashraf & Devadoss, 2014) and one AQ Cohort study (Sawaizumi et al., 2007).*

Trigger finger

The evidence indicates that the risk of serious adverse events related to steroid injections for trigger finger is low. The most often reported adverse events are minor and include hypopigmentation at the injection site, infection of the flexor sheath, steroid flare and injection-related pain. Tendon rupture associated with repeated injections for trigger finger has been reported, although it is rare. Necrotising fasciitis has been reported in a single case study. *Level B recommendation based on one LQ SR (Akhtar & Burke 2006), one HQ RCT (Peters-Veluthamaningal et al. 2008) and one LQ RCT (Shakeel & Ahmad 2012).*

Dupuytren's disease

The evidence indicates that the risk of serious adverse events related to steroid injections for Dupuytren's disease is low. The most often reported adverse events are minor and include hypopigmentation and subcutaneous atrophy at the injection site. *Level B recommendation based on one HQ SR (Ball et al., 2016).*

Ganglion cysts

The evidence indicates that the risk of serious adverse events related to steroid injections for ganglion cysts is low. The most often reported adverse events are minor and include mild parathesia, mild depigmentation, thrombophlebitis at injection site and increased pain at injection site. *Level B Recommendation based on one LQ RCT (Manjunatha 2016) and one AQ Cohort study (Datta & Rao 2016)*.

4. Recommendations

Summary of Recommendations

Pain and function

First Carpometacarpal Joint

- **The evidence suggests that steroid injections for thumb-base osteoarthritis should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on conflicting results from one LQ SR (Spaans et al., 2015) demonstrating short term benefit of steroid injections for pain relief, one AQ SR (Trellu et al., 2015) demonstrating steroid injections were no more effective than placebo up to 24 weeks, and one AQ RCT (Makarawung et al., 2013) demonstrating catastrophic thinking was a better predictor of disability and pain intensity than type of injection up to 3 months after injection.
- **The evidence suggests that the effectiveness of steroid injection compared to hyaluronate injection for relief of pain in thumb-base osteoarthritis remains unclear.** Level B Recommendation based on conflicting results from one LQ SR (Spaans et al., 2015) demonstrating greater long term benefit of HA for pain relief and one AQ SR (Trellu et al., 2015) demonstrating greater long term benefit of steroids for pain relief.

de Quervain's disease (stenosing tenosynovitis)

- **The evidence suggests that steroid injections are effective in reducing pain and improving function in patients with de Quervain's disease.** Level A Recommendation based on two HQ SRs (Ashraf & Devadoss 2014, Cavaleri et al., 2015) and one HQ RCT (Peters-Veluthamaningal et al., 2009).
- **The evidence suggests that steroid injections are more effective in reducing pain and improving function in patients with de Quervain's disease when combined with hand therapy.** Level B Recommendation based on one HQ SR (Cavaleri et al., 2015).

Trigger finger

- **The evidence suggests that steroid injections are effective in reducing pain and improving function in patients with trigger finger compared to placebo.** Level B Recommendation based on one HQ SR (Peters-Veluthamaningal et al., 2009).
- **The evidence indicates that steroid injections are less effective than percutaneous A1 pulley release for pain and recurrence in patients with trigger finger.** Level B Recommendation based on the results from one HQ RCT (Sato et al., 2012), and one AQ RCT (Zyluk & Jagielski 2011).
- **The evidence suggests that steroid injections with lidocaine are more effective than lidocaine alone in reducing pain.** Level B Recommendation based on one HQ SR (Peters-Veluthamaningal et al., 2009).
- **The evidence suggests that steroid injections are as effective as extracorporeal shock wave therapy alone in reducing pain.** Level B recommendation based on one HQ RCT (Yildirim et al., 2016).
- **The evidence indicates that steroid injections are not as effective as open**

surgery for reducing pain in patients with trigger finger. Level B recommendation based on the results from one HQ RCT (Sato et al., 2012).

- **The evidence indicates that the effectiveness of steroid injections for reducing pain and improving function is improved when used in combination with hyaluronate injection in patients with trigger finger.** Level B recommendation based on the results from one HQ RCT (Liu et al., 2015) and one LQ RCT (Callegari et al., 2011).

Dupuytren's disease

- **The evidence suggests that steroid injections for Dupuytren's disease should not be first line of treatment as the evidence remains unclear**. Level B Recommendation based on one HQ SR (Ball et al., 2016 SR (HQ).

Ganglion cysts

- **The evidence suggests that steroid injections for ganglion cysts should not be first line of treatment as the evidence remains unclear.** Level B Recommendation based on one LQ SR (Meena and Gupta 2014 SR (LQ).

Complications

- **Minor complications associated with steroid injections to the hand are not uncommon, but rarely require significant medical attention.** Level A recommendation.

Value of imaging

- **The evidence indicates that ultrasound guided injections are:**
  - **No better than blinded steroid injections for relieving pain and improving functional status in patients with trigger finger.** Level C Recommendation based on results from one LQ RCT (Cecen et al. 2015).
  - **Better than manual steroid injections for relieving pain in patients with de Quervain's disease.** Level B Recommendation based on results from one AQ RCT (Kume et al. 2012).

Economic

- **This review found no evidence related to the economic implications of steroid injections to the hand as an interventional pain management treatment.**

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6. Appendices

Appendix 1: Sign Checklists Used in this Review

SIGN Critical Appraisal Tool for Systematic Reviews and Meta-analyses

SIGN

Methodology Checklist 1: Systematic Reviews and Meta-analyses

SIGN gratefully acknowledges the permission received from the authors of the AMSTAR tool to base this checklist on their work: *Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C,. et al., Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Medical Research Methodology 2007, **7**:10 doi:10.1186/1471-2288-7-10. Available from http://www.biomedcentralcom/1471-2288/7/10 [cited 10 Sep 2012]*

Study identification (*Include author, title, year of publication, journal title, pages*)	
Guideline topic:	Key Question No:

Before completing this checklist, consider:

Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO reject. IF YES complete the checklist.

Checklist completed by:

Section 1: Internal validity

	In a well conducted systematic review:	***Does this study do it?***
1.1	The research question is clearly defined and the inclusion/ exclusion criteria must be listed in the paper.	Yes □ No □ **If no reject**
1.2	A comprehensive literature search is carried out.	Yes □ No □ Not applicable □ **If no reject**
1.3	At least two people should have selected studies.	Yes □ No □ Can't say □
1.4	At least two people should have extracted data.	Yes □ No □ Can't say □
1.5	The status of publication was not used as an inclusion criterion.	Yes □ No □
1.6	The excluded studies are listed.	Yes □ No □
1.7	The relevant characteristics of the included studies are provided.	Yes □ No □
1.8	The scientific quality of the included studies was assessed and reported.	Yes □ No □
1.9	Was the scientific quality of the included studies used appropriately?	Yes □ No □
1.10	Appropriate methods are used to combine the individual study findings.	Yes □ No □ Can't say □ Not applicable □
1.11	The likelihood of publication bias was assessed appropriately.	Yes □ No □

		Not applicable □
1.12	Conflicts of interest are declared.	Yes □ No □
SECTION 2: OVERALL ASSESSMENT OF THE STUDY		
2.1	What is your overall assessment of the methodological quality of this review?	High quality (++) □ Acceptable (+) □ Low quality (-)□ Unacceptable – reject 0 □
2.2	Are the results of this study directly applicable to the patient group targeted by this guideline?	Yes □ No □
2.3	**Notes:**	

SIGN Critical Appraisal Tool for Controlled trials

Methodology Checklist 2: Controlled Trials

Study identification (*Include author, title, year of publication, journal title, pages*)		
Guideline topic:	Key Question No:	Reviewer:

Before completing this checklist, consider:

1. Is the paper a **randomised controlled trial** or a **controlled clinical trial**? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist. If it is a **controlled clinical trial** questions 1.2, 1.3, and 1.4 are not relevant, and the study cannot be rated higher than 1+
2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist.

Reason for rejection: 1. Paper not relevant to key question ☐ 2. Other reason ☐ (please specify):

SECTION 1: INTERNAL VALIDITY

In a well conducted RCT study…		***Does this study do it?***
1.1	The study addresses an appropriate and clearly focused question.	Yes ☐ No ☐ Can't say ☐
1.2	The assignment of subjects to treatment groups is randomised.	Yes ☐ No ☐ Can't say ☐
1.3	An adequate concealment method is used.	Yes ☐ No ☐ Can't say ☐
1.4	The design keeps subjects and investigators 'blind' about treatment allocation.	Yes ☐ No ☐ Can't say ☐
1.5	The treatment and control groups are similar at the start of the trial	Yes ☐ No ☐ Can't say ☐
1.6	The only difference between groups is the treatment under investigation.	Yes ☐ No ☐ Can't say ☐
1.7	All relevant outcomes are measured in a standard, valid and reliable way.	Yes ☐ No ☐ Can't say ☐
1.8	What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed?	
1.9	All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis).	Yes ☐ No ☐ Can't say ☐ Does not apply ☐
1.10	Where the study is carried out at more than one site, results are comparable for all sites.	Yes ☐ No ☐ Can't say ☐ Does not apply ☐

SECTION 2: OVERALL ASSESSMENT OF THE STUDY

2.1	How well was the study done to minimise bias? *Code as follows:*	High quality (++)☐

		Acceptable (+)☐ Low quality (-)☐ Unacceptable – reject 0 ☐
2.2	Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?	
2.3	Are the results of this study directly applicable to the patient group targeted by this guideline?	
2.4	**Notes.** Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.	

Appendix 2: Quality scores for Systematic Reviews used in this Review

Dupuytren

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Ball et al	2016	Y	Y	Y	CS	Y	Y	Y	Y	Y	Y	N	Y	HQ(++)	Y

General/ Multiple Types

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Peterson & Hodler	2010	Y	Y	CS	CS	Y	N	N	N	N	N	N	N	LQ(-)	Y
van Middelkoop et al	2009	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	AQ(+)	Y

Thumb

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Kloppenburg	2014	Y	N	CS	CS	Y	N	Y	N	N	N	N	Y	LQ(-)	Y
Spaans et al	2015	Y	Y	CS	CS	N	N	Y	N	N	N	N	Y	LQ(-)	Y
Trellu et al	2015	Y	Y	N	N	Y	N	Y	Y	Y	Y	M	Y	AQ(+)	Y

Trigger Finger

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Akhtar & Burke	2006	Y	Y	CS	CS	N	N	Y	N	N	N	N	Y	LQ(-)	Y
Fleisch et al	2007	Y	Y	CS	CS	N	N	Y	N	N	N	N	Y	LQ(-)	Y
Peters-Velutham et al	2009	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	HQ(++)	Y

De Quervian tenosynovitis

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Ashraf & Devadoss	2014	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	HQ(++)	Y
Cavaleri et al	2015	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	HQ(++)	Y
Coldham	2006	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N	AQ(+)	Y
Peters-Velutham et al	2009	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	HQ(++)	Y
Richie & Briner	2003	Y	Y	CS	CS	N	N	Y	N	N	N	N	N	LQ(-)	Y

Ganglion Cysts

Reference (author, year)		Quest													
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**1.11**	**1.12**	**2.1**	**2.2**
Meena and Gupta	2014	Y	N	N	N	N	N	N	N	N	N	N	Y	LQ(-)	Y
Head et al	2015	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	HQ(++)	Y

Appendix 3: Data Extraction for Systematic Reviews used in this Review

Dupuytren's

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence 1	2	3	4	Grade
Ball et al, 2016	HQ(++)	Steroid injection vs other treatment methods	3 Case Series; N =74	Nodule disappearance; softened palmar fibrosis; ease of injection	• Intra-lesional steroid injection and radiotherapy appeared to lead to softening of nodules and to retard disease progression but lacked rigorous evaluation and studies were poorly designed.	0	1	0	0	1-

General

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence 1	2	3	4	Grade
Peterson & Hodler, 2010	LQ(-)	Steroid injection vs other treatment methods	1 SR, 4 RCTs; N = 393	Complete resolution of symptoms; Function on Finkelstein test; Pain	• For de Quervain's; steroid injection alone appears to be the superior treatment	0	0	0	0	1-
					• For CMC; Steroid provided faster short term pain relief but viscosupplementation was superior at 6 mths follow up (VAS score decrease of 56% at 26 weeks for hyaluronic acid compared to 22.6% in steroid injection	0	0	0	0	1-
van Middelkoop et al, 2009	AQ(+)	Steroid injection vs other treatment methods	3 RCTs; N = 203	Trigger relief; Pain	• For Trigger Finger: Limited evidence in support of steroid injection (1 LQ RCT)	0	1	0	0	1-
					• For de Quervain's; No clear differences between steroid injection and splinting (1 LQ RCT) and no efficacy of Nimesulide as addition to steroid injection (1 LQ RCT)	0	1	0	0	1-

Thumb

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence 1	2	3	4	Grade
Kloppenburg, 2014	LQ(-)	CSI vs other treatment methods	3 RCTs; N = 300	Pain	• Insufficient data exists to conclude on the efficacy of intra-articular steroid for patients with thumb base OA	0	0	0	0	1-
Spaans et al, 2015	LQ(-)	Intra-articular steroid injection vs placebo vs hyaluronate intra-articular injections	5 RCTs; N = 248	Pain; joint function	• Some evidence for pain relief by intra-articular steroid injection for patients with TMC OA	0	0	1	1	1
					• Injection of hyaluronate injections more effective than steroid injection with longer-lasting effect	0	0	1	1	1
Trellu et al, 2015	AQ(+)	Intra-articular steroid injection vs placebo vs hyaluronic acid injection	7 RCTs; N = 524	Pain; functional capacity; pulp pinch force	• Steroid injection no different to placebo at 12 wks for pain and function, pain sig. lower in steroid injection at 24 wks	1	1	1	1	1++
					• Hyaluronic acid may be useful to increase functional capacity while steroid injection is useful to decrease pain at 24 wks	1	1	1	1	1++

Trigger Finger

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence 1	2	3	4	Grade
Akhtar & Burke, 2006	LQ(-)	Steroid injection	6 cohort (3 Pro/3 Retro); N = 555	'Cure' of treatment	• Steroid injection in the flexor sheath at the level of the A1 pulley is an effective method of treating patients with trigger finger	0	0	0	0	1-
Fleisch et al, 2007	LQ(-)	Steroid injection vs placebo	4 RCTs; N = 285	Pain	• EBM examination found corticosteroid injection provided relief in 57% of patients	0	0	0	0	1-
					• Evidence contrasts to other studies which suggest 87% usefulness	0	0	0	0	1-
Peters-Velutham et al, 2009	HQ(++)	Steroid injection with lidocaine vs lidocaine alone	2 RCTs; N = 63	Treatment success (complete resolution of symptoms or being asymptomatic)	• steroid injection with lidocaine was more effective that lidocaine alone on treatment success at 4 wks (Peters-Velutham et al, 2009; SR HQ(++))	1	1	0	0	1
					• Short-term effects recorded for combination, 1 study showed steroid injection effects up to 4 mths (Peters-Velutham et al, 2009; SR HQ(++))	1	1	0	0	1

De Quervain's Tenosynovitis

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence 1	2	3	4	Grade
Ashraf & Devadoss, 2014	HQ(++)	Steroid injection vs splinting	2 RCTs; N = 91	Resolution of tenderness over the 1st dorsal; Finkelstein test	• Steroid injection is an effective form of conservative management for de Quervain's disease	1	1	0	0	1
					• Steroid injection was more effective than splinting	1	1	0	0	1
Cavaleri et al, 2015	HQ(++)	Steroid injection vs hand therapy	6 RCTs; N = 334	Intervention Success; Finkelstein test; pain, function, QoL	• Both steroid injection and hand therapy improved pain and function from baseline	1	1	1	1	1++
					• Sig. more effective treatment when steroid injection and hand therapy combined than when separated	1	1	1	1	1++
Coldham, 2006	AQ(++)	Steroid injection vs splinting	1 RCT, 3 Cohort (2 Pro/1 Retro); N = 494	Length of follow-up; Pain; functional improvement; tender wrist; Finkelstein test	• Steroid injection was more effective than splinting, especially with more severe symptoms	0	1	0	0	1-
Peters-Velutham et al, 2009	HQ(++)	Steroid vs splinting	1 RCT; N = 18	Pain	• All steroid injection parts experienced complete relief of pain compared to 0 parts in splinting group, 1-6 days after intervention	0	1	0	0	1-
					• steroid injection more effective than splinting	0	1	0	0	1-
Richie & Briner, 2003	LQ(-)	Steroid injection vs other treatment methods	7 Pro cohorts; N = 459 wrists	Finkelstein test; pain; absence tender 1st dorsal	• 83% 'cure' (absence of diagnostic criteria) rate for injection alone vs injection with splinting, splint alone, or rest	0	0	0	0	1-
					• Injection alone appears most effective for de Quervain's tenosynovitis	0	0	0	0	1-

Ganglion Cysts

Author and year	SIGN Score	Approach	Studies (patient No)	Outcome	Conclusions	Evidence				Grade
						1	2	3	4	
Meena and Gupta (2014)	LQ(-)	Steroid injection	NR	Recurrence Rate	• Limited benefit from injection of steroids at the time of aspiration.	0	0	0	0	-1
Head et al., (2015)	HQ(+)	Steroid injection at time of aspiration	NR separately for CSI	Recurrence Rate	• Unable to distinguish CSI injection from other forms of treatment; Cannot reach a conclusion relevant to this review due to this	1	1	1	1	1++

Appendix 4: List of RCTs within the Systematic Reviews used in this Review

Please note: the systematic review on Dupuytren's disease did not include any RCTs and it has therefore been excluded from the appendix.

	Systematic Reviews (review period)																									
		de Quervain's						Trigger Finger					Thumb				General			Ganglion						
		Ashraf & Devadoss, 2014	Cavaleri et al, 2015	Coldham, 2006	Peters-Velutham et al, 2009b	Richie & Briner, 2003		Akhtar & Burke, 2006	Fleisch et al, 2007	Peters-Velutham et al, 2009a			Kloppenburg, 2014	Spaans et al, 2015	Trellu et al, 2015		Peterson & Hodler, 2010	van Middelkoop et al, 2009		Head et al., (2015)						
RCTs																										
Ansari et al., 2014			1				1																			
Avci et al., 2002		1	1	1	1		4											1	1							
Bahadir et al., 2009														1	1	2										
Dehghan et al., 2012			1				1																			
Fuchs et al., 2006														1	1	2	1		1							
Goldfarb et al., 2007																	1		1							
Hadianfard et al., 2013			1				1																			
Heyworth et al., 2008													1	1	1	3										
Jiarattanaphochai et al., 2004																	1	1	2							
Lambert et al., 1992									1	1	2															
Mandl et al., 2012													1		1	2										
Maneerit et al., 2003									1		1															
Mardini-Kivi et al., 2014			1				1																			
Meenagh et al., 2004													1	1	1	3										
Mehdinasab et al., 2010		1	1				2																			
Monfort et al., 2014															1	1										
Murphy et al., 1995									1	1	2							1	1							
Stahl et al., 2005														1	1	2	1		1							
Taras et al., 1998									1		1															
Varley et al., 1997																				1						
Total RCTs	**0**						**10**				**5**					**15**			**7**							**1**

Appendix 5: Quality scores for randomised controlled trials used in this Review

Please note: There were no RCTs for Dupuytren's disease or ganglion cysts which were not contained in systematic reviews, and therefore they have been intentionally removed from the below appendix

De Quervain's Tenosynovitis

Reference (author, year)		Quest												
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**2.1**	**2.2**	**2.3**
Kume et al	2012	Y	Y	Y	CS	Y	CS	Y	5/44	N	CS	AQ(+)	Y	Y
2.4	US-guided injection targeting the EPB in dQD patients with septation is more effective than manual injection.													
Peters-Velutham et al	2009	Y	Y	Y	Y	Y	Y	Y	10/21	N	N	HQ(++)	Y	Y
2.4	One or two local injections of 1 ml triamcinolonacetonide 10 mg/ml provided by general practitioners leads to improvement in the short term in participants with de Quervain's tenosynovitis when compared to placebo. The short-term beneficial effects of steroid injections for symptoms were maintained during the follow-up after 12 months.													

Thumb

Reference (author, year)		Quest												
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**2.1**	**2.2**	**2.3**
Jahangiri et al	2014	Y	Y	Y	Y	Y	Y	Y	5/60	N	NA	HQ(++)	Y	Y
2.4	For the long term, hypertonic dextrose seems to be more advantageous, while the two treatments were comparable in the short term. Because of the satisfactory pain relief and restoring of function, we would prefer hypertonic dextrose prolotherapy for the treatment of patients with OA.													

Trigger Finger

Reference (author, year)		Quest												
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**2.1**	**2.2**	**2.3**
Callegari et al	2011	Y	Y	N	N	Y	CS	Y	NR	N	NA	LQ(-)	Y	Y
2.4	Results of this explorative study suggest that ultrasound-guided injection of a corticosteroid and hyaluronic acid could be a safe and feasible approach for the treatment of trigger finger.													
Cecen et al	2015	Y	Y	CS	CS	Y	CS	Y	4/70	N	NA	LQ(-)	Y	Y
2.4	The use of ultrasound-guided injection of corticosteroid may be associated with extra time and effort, with no superior clinical benefits compared to the blinded technique.													
Chao et al	2009	Y	Y	N	CS	Y	CS	Y	3/86	N	NA	LQ(-)	Y	Y
2.4	Percutaneous release with a miniscalpel-needle had a higher success rate than steroid injection.													
Jianmongkol et al	2007	Y	Y	CS	CS	Y	Y	Y	NR	N	CS	AQ(+)	Y	Y
2.4	MAI injection technique provided less pain result than the CI technique and there were no complications from this injection technique, and may be a safe injection for trigger finger													
Liu et al	2015	Y	Y	Y	Y	Y	CS	Y	1/36	Y	NA	HQ(++)	Y	Y
2.4	Ultrasound-guided injection of HA demonstrated promising results for the treatment of trigger fingers. The optimal frequency, dosage, and molecular weight of HA injections for trigger fingers deserve further investigation for future clinical applications													
Park et al	2014	Y	Y	Y	CS	Y	CS	Y	0.00%	NA	NA	AQ(+)	Y	Y
2.4	Concomitant vibratory stimulation does not reduce pain experienced during corticosteroid injections for trigger finger.													

Reference (author, year)		Quest												
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**2.1**	**2.2**	**2.3**
Pataradool & Buranapuntaruk	2011	Y	Y	N	N	Y	CS	Y	9/40	N	NA	LQ(-)	Y	Y
2.4	PPI technique is less painful than the CI technique without any significant difference in recurrence rate between the two groups at three months follow-up													
Peters-Velutham et al	2008	Y	Y	Y	Y	Y	CS	Y	9/50	N	CS	HQ(++)	Y	Y
2.4	Local injection with TCA is effective and safe for treating trigger finger as compared to placebo injection. The effects of steroid injections last up to 12 months.													
Ring et al	2008	Y	Y	N	N	Y	CS	Y	29/84	N	CS	LQ(-)	Y	Y
2.4	Although there were no differences 3 months after injection, our data suggest that triamcinolone may have a more rapid but ultimately less durable effect on idiopathic trigger finger than does dexamethasone													
Salim et al	2011	Y	Y	N	CS	Y	CS	Y	10/84	N	NA	LQ(-)	Y	Y
2.4	Corticosteroid injection has a better outcome compared to physiotherapy in the treatment of mild trigger fingers but physiotherapy may have a role in prevention of recurrence													
Sato et al	2012	Y	Y	Y	Y	Y	CS	Y	0.00	N	NA	HQ(++)	Y	Y
2.4	The percutaneous and open surgery methods displayed similar effectiveness and proved superior to the conservative CS method regarding the trigger cure and relapse rates.													
Shakeel & Ahmad	2012	Y	Y	N	Y	CS	CS	Y	10/110	N	NA	LQ(-)	Y	Y
2.4	Although steroids gave quicker relief, NSAID injections are equally effective at 3 months in the treatment of trigger digits. We were unable to detect a statistically significant difference in the response of patients with and without diabetes to either treatment													
Sibbitt et al	2011	Y	Y	CS	CS	Y	CS	Y	NR	N	CS	LQ(-)	Y	Y
2.4	Nerve block anesthesia at the wrist before palmar injection is preferred by patients and is highly effective in preventing pain associated with injection of the palmar hand for trigger finger and other painful hand procedures.													
Yildirim et al	2016	Y	Y	Y	CS	Y	Y	Y	4/40	Y	NA	HA(++)	Y	Y
2.4	Extracorporeal shock wave therapy could be a non-invasive option for treating trigger finger, especially for those patients who wish to avoid steroid injections.													
Zyluk & Jagielski	2011	Y	Y	Y	Y	Y	CS	Y	17%	N	NA	AQ(+)	Y	Y
2.4	Percutaneous A1 pulley release is more effective medium-term therapy for trigger digit than steroid injection, because of lower risk of recurrence.													

General

Reference (author, year)		Quest												
Study	**Year**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.10**	**2.1**	**2.2**	**2.3**
Makarawung et al	2013	Y	Y	CS	Y	Y	CS	Y	6/42	N	NA	AQ(+)	Y	Y
2.4	Catastrophic thinking was a better predictor of both of arm-specific disability and pain intensity than diagnosis or type of injection (steroid vs. placebo) 1 to 3 months after an injection													

Appendix 6: Data Extraction for randomised controlled trials used in this Review

Please note: There were no RCTs for Dupuytren's disease or ganglion cysts which were not contained in systematic reviews, and therefore they have been intentionally removed from the below appendix

De Quervain's Tendonitis

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Kume et al	2012	Japan	RCT	Triamcinolone	40mg/ml	1ml 1% lidocaine	VAS	Baseline + 4 wks	Pain on the VAS showed a more significant decrease in the US-guided than in the manual injection group (p = 0.0007) from baseline to 4 weeks after injection.					Rate of Surgery @ 6 wks	US-guided injection targeting the EPB in dQD patients with septation is more effective than manual injection.	No adverse events	Ultrasound	44	44.5 years	dQD labelled as history of pain in the first dorsal compartment of the wrist	Positive Finkelstein's test	NR
Peters-Veluthamet al	2009	The Netherlands	RCT	Triamcinolonacetonide	10mg/ml		VAS	Baseline + 1, 3. 6, 12 mths	The TCA-group had better results for short-term outcomes treatment response (78% vs. 25%; p = 0.015), perceived improvement (78% vs. 33%; p = 0.047) and severity of pain (4.27 vs. 1.33; p = 0.031) but not for the Dutch-AIMS-HFF (2.71 vs. 1.92; p = 0.112). Absolute risk reduction for the main outcome short-term treatment response was 0.55 (95% CI: 0.34, 0.76) with a number needed to treat of 2 (95% CI: 1, 3).		DUTCH AIMS-2-HFF (BL, 1, 3, 6, 12 mths)		Direct treatment response	Adverse events	One or two local injections of 1 ml triamcinolonacetonide 10 mg/ml provided by general practitioners leads to improvement in the short term in participants with de Quervain's tenosynovitis when compared to placebo. The short-term beneficial effects of steroid injections for symptoms were maintained during the follow-up after 12 months.	No serious events. Hot flushes (n =2) and steroid flare (n=6)		21	51.5 years	dQD as pain or tenderness at the radial styloid w or w/o crepitations on palpitation at the radial styloid	Positive Finkelstein's test	NR

Thumb

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Jahangiri et al	2014	Iran	RCT	Methylprednisolone acetate	40mg/0.5ml	0.5ml 2% lidocaine	VAS; Fischer's pressure algometer (pain)	Baseline, 1, 2, 6 mths	The two groups were comparable at 2 months, but significantly different at 1 month, with better results for corticosteroid, and at 6 months with apparently more favourable outcome for DX [mean difference (95 % CI) in VAS = 1.1 (0.2, 2.0), p = 0.02]. After 6 months of treatment, both DX and corticosteroid injection increased functional level, but DX seemed to be more effective [mean difference (95 % CI) in total function score = 1.0 (0.2, 1.8), p = 0.01].	Pain on joint movement (VAS); Pinch gauge; at baseline 1, 2, 6 mths	HAD-QI at baseline 1, 2, 6 mths				For the long term, hypertonic dextrose seems to be more advantageous, while the two treatments were comparable in the short term. Because of the satisfactory pain relief and restoring of function, we would prefer hypertonic dextrose prolotherapy for the treatment of patients with OA.			60	63.6-63.9 years	History of pain in CMC1 for at least 3 months and pain with the intensity of more than 30 in a 100-mm visual analog scale (VAS) at the baseline visit, + radiographic evidence	Diagnosis according to Eaton classification	up to 11.3mths

General

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Makarawung et al	2013	USA	RCT	Dexamethasone injection	1ml/4mg	1ml 1% lidocaine	Pain (VAS)	@ Baseline + 1-3 months post enrolment	Type of injection was not a predictor of arm-specific disability or pain intensity 1 to 3 months after injection. The best model both for arm-specific disability and pain intensity at follow-up included pain catastrophizing and explained 18 % and 33 % of the variability, respectively.	DASH	CES-D		PCS; MHLC; Satisfaction (VAS)		Catastrophic thinking was a better predictor of both of arm-specific disability and pain intensity than diagnosis or type of injection (steroid vs. placebo) 1to 3 months after an injection			36	48-55 years	de Quervain's: Palpation over the first dorsal compartment of the wrist, and active or passive ulnar deviation with a fist around the thumb. Thumb: Patients with pain at the base of the thumb that could be reproduced along with crepitation by pushing and moving the thumb metacarpal against the trapezium	Finkelstein maneuver for DQ; The Grind Test for CMC	

Trigger Finger

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Jianmongkol et al	2007	Thailand	RCT	Triamcinolone hexacetonide	10mg	Lidocaine	VAS & Paracetamol count	Baseline, 1, 3, & 6 wks	The results showed that the mean VAS pain scores immediately after needle insertion were 40.19 ± 23.3 and 48.39 ± 26.5 in the MAI and CI technique groups, respectively. The MAI technique was less painful than the CI technique ($p < 0.05$). There were no complications from the injections in both methods. However, the recurrent rate seems to be higher in the conventional technique ($p = 0.23$)						MAI injection technique provided less pain result than the CI technique and there were no complications from this injection technique, and may be a safe injection for trigger finger			103	28-79; 52/53 yrs			
Peters-Veluthamet al	2008	The Netherlands	DB RCT	Triamcinolonacetonide	1 ml		NRS	Baseline, 1, 3, 6, 12 mths	Proportion of patients with satisfactory immediate treatment response 16/25 and 5/25 (p,0.001), patients with reduction in the frequency of triggering 13/24 and 6/22 (p=0.053), mean difference in severity of pain 4.2 and 0.9 (p,0.001), patients perceiving improvement 22/25 and 9/25 (p=0.001) and difference in Arthritis Impact Measurement Scale 2 (AIMS-2) score 4.02 and 0.06 (p=0.001). The short-term beneficial effects were maintained during the follow-up phase of 12 months.	Frequency of triggering (likert) @ Baseline, 1, 3, 6, 12 mths	Dutch-AIMS-2; Resolution of symptoms (Likert) @ Baseline, 1, 3, 6, 12 mths		Satisfaction NRS @ Baseline, 1, 3, 6, 12 mths	Direct treatment response (Likert) @ Baseline, 1, 3, 6, 12 mths	Local injection with TCA is effective and safe for treating trigger finger as compared to placebo injection. The effects of steroid injections last up to 12 months.			50	63 yrs	A clinical diagnosis of trigger finger was defined as a history of triggering or locking of a finger with or without pain and tenderness or swelling at the A1 pulley.		

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Ring et al	2008	USA	Pros RCT	Dexamethasone OR Triamcinolone	Tri, 10mg/ml; Dex, 4mg/ml	1% lidocaine (1:1 mx)	DASH	Baseline, 6 wks, 3 mths	Six weeks after injection, absence of triggering was documented in 22/35 patients in the triamcinolone cohort and in 12/32 patients in the dexamethasone cohort. The rates 3 months after injection were 27/41 in the triamcinolone cohort and 22/31 in the dexamethasone cohort. The triamcinolone cohort had significantly better satisfaction and Quinnell grades than did the dexamethasone cohort at the 6-week follow-up but not at the 3-month follow-up. There were no significant differences between DASH scores at the 6-week follow-up and the 3-month follow-up. After the close of the study, there were 8 recurrences among patients with documented absence of triggering in the triamcinolone cohort and 1 in the dexamethasone cohort.	Quinnell Grade triggering @ Baseline, 6 wks, 3 mths			Satisfaction (VAS) @ Baseline, 6 wks, 3 mths		Although there were no differences 3 months after injection, our data suggest that triamcinolone may have a more rapid but ultimately less durable effect on idiopathic trigger finger than does dexamethasone			84	30-93 yrs, av: 64 yrs	Any adult patient (age 18 years or greater) with an isolated new diagnosis of 1 or more idiopathic trigger fingers of any Quinnell grade 2 or greater.	Quinnell Grade of triggering	
Chao et al	2009	China	RCT	Triamcinolone acetonide	10 mg/ml	0.5ml 1% lidocane	VAS	Baseline, 1 & 12 mths	Forty-four of the 46 trigger thumbs in MSN release and 12 of 47 trigger thumbs in CSI had satisfactory results at 12 months. No digital nerve injury occurred in either group.	Grade of triggering @ baseline, 1 & 12 mth			Procedure 'success' @ 1 wk		Percutaneous release with a miniscalpel-needle had a higher success rate than steroid injection.	No adverse events		86	48.5 years (27-65	Idiopathic adult trigger thumbs	Grade III–V on the Quinnell classification	
Callegari et al	2011	Italy	OL RT	Methylprednisolone acetate	40mg/1ml	0.8ml 2% lidocaine chlorhydrate	VAS	Baseline, 6 & 12 mths	Pain imp. @ 6/12 (sig. not calculated); Total resolution 14/15 @ 6/12; 11/15 @ 12/12; Satisfaction Imp. @ 6/12 (sig. not calculated)	DASH @ 6/12, 12/12			Satisfaction (VAS) 6/12, 12/12		Results of this explorative study suggest that ultrasound-guided injection of a corticosteroid and hyaluronic acid could be a safe and feasible approach for the treatment of trigger finger.		30	52.5 yrs		clinical signs and symptoms of stenosing tenosynovitis of the flexor tendons and in whom diagnosis was confirmed by ultrasound	Ultrasound assessment	
Pataradool & Buranapuntaruk	2011	Thailand	RCT	Triamcinolone acetonide	1ml/0.1%	Lidocaine 1%	VAS	Baseline, 3ths	The mean pain VAS scores immediately post-injection were 7:3 ± 1:3 and 3:2 ± 2:2 in the CI and P1I techniques, respectively. The P1I technique group had a significantly lower pain score than CI technique group (p < 0:001). The recurrence rate was 15% in the CI technique when compared to 25% in the P1I technique which was not significant (p = 0:685).	Recurrence of triggering @ 3ths					PPI technique is less painful than the CI technique without any significant difference in recurrence rate between the two groups at three months follow-up			40	28-80; 60/55 yrs	Any adult patients with primary trigger digit of Quinnell grades I-III who were not responsive to oral medications	Quinnell Grade of triggering	

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
							Outcome measures	Outcome Assessment Timepoints	Results	ROM	Disability	RTW	QoL	OTHER				N	Age (central tendency and variation)	Diagnostic Label	Diagnostic Tests	Duration of Pain
Sibbitt et al	2011	USA	RCT	Trimcinolone acetonide	0.5ml		VAS	Baseline, procedure, injection, 2wks	Nerve blocks at the wrist provided effective anaesthesia, resulting in a 56% reduction in injection pain compared with direct injection (P = 0.01). There was 100% resolution of trigger finger in both treatment groups. Pain at the 2-week outcome, reduction in pain from baseline, responders, and non-responders were not statistically different (P > 0.3 for all). Eighty-eight percent of subjects preferred nerve block anaesthesia to direct injection (P < 0.0001).	Extend and Flex of triggered finger @ baseline & 2 wks					Nerve block anaesthesia at the wrist before palmar injection is preferred by patients and is highly effective in preventing pain associated with injection of the palmar hand for trigger finger and other painful hand procedures.	.		19	54.9-57.8yrs	Inclusion criteria included (1) painful trigger finger on patient complaint and physical examination, (2) symptoms persisting for more than 1 month, and (3) the desire of the patient to have an injection rather than referral for surgery		
Zyluk & Jagielski	2011	Poland	Pros RCT	Betamethasone	1ml		VAS	Baseline, 1 & 6 mths	At the 1 month assessment, patients after steroid injection achieved greater active range of movement of the fingers (270 vs 264) and stronger grip (99% vs 85%) than those treated by percutaneous release. At the 6 month assessment six recurrences (11%) occurred in the steroid injection group and none in the percutaneous release group (P¼0.005). Patients after percutaneous release had less pain on movement of the involved digit (VAS 0.4 vs 1.3), but still had lower AROM of the fingers (265 vs 270 after steroid injection).	Active ROM; Grip strength @ Baseline, 1 & 6 mths					Percutaneous A1 pulley release is more effective medium-term therapy for trigger digit than steroid injection, because of lower risk of recurrence			115	56 yrs	Clinical symptoms and signs: triggering, tenderness at the base of the affected digit or its complete locking	Froimson grade of triggering	5 mths
Salim et al	2011	Malaysia	Pros RCT	Triamcinolone acetonide	1ml	1ml 2% Lignocaine	VAS	Baseline, 6wks, 3 mths	At 3 months, the success rate (absence of pain and triggering) for those receiving steroid injection was 97.4% and physiotherapy 68.6%. The group receiving steroid injection also had lower pain score, higher rate of satisfaction, stronger grip strength and early recovery to near normal function (findings were all significant, p<0.05). At 6 months, only those who were successfully treated were further questioned on recurrence (presence of pain and triggering). Those who received corticosteroid injections had a significant recurrence rate of pain but not triggering. The physiotherapy group had no recurrence of pain or triggering due to the type of triggering responsive to physiotherapy or possibly due to awareness of physiotherapy exercises	JAMAR grip @ Baseline, 6wks, 3 mths	Hand function for ADLs @ Baseline, 6wks, 3 mths			Success rate @ 3mths & 6 mths	Corticosteroid injection has a better outcome compared to physiotherapy in the treatment of mild trigger fingers but physiotherapy may have a role in prevention of recurrence			84	58.9yrs	Inclusion criteria were patients older than 20 years old diagnosed with Grade 0, 1 and 2 trigger finger based on the Quinnell classification	Quinnell Grade of triggering	
Sato et al	2012	Brazil	RT Clin	Methylprednisolone acetate 2ml	40mg/ml		Topical VAS + Articular VAS	Baseline, 1 & 2 wks, 1, 2, 4, & 6 mths	The trigger cure rate for patients in the injection method group was 57%, and wherever necessary, two injections were administered, which increased the cure rate to 86%. For the percutaneous and open release methods, remission of the trigger was achieved in all cases.	Total Active Motion @ Baseline, 1 & 2 wks, 1, 2, 4, & 6 mths				Cure' rate @ 6mths	The percutaneous and open surgery methods displayed similar effectiveness and proved superior to the conservative CS method regarding the trigger cure and relapse rates.			150	55.29 yrs (CSI group)	Symptomatologies of trigger finger movement blockage on either hand in subjects who had not undergone previous treatment of any type	Quinnell Grade of triggering 2-4	

Author	Year	Country	Study design	Steroid	Dose (mg)	+/- Local Anaesthetic	Pain			Functional outcomes					Conclusions	Safety and Risk	Imaging	Population Characteristics				
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Shakeel & Ahmad	2012	Malaysia	Pros DB RCT	Triamcinolone acetonide	20mg		Pain was not measured	Baseline, 3 wks, 3 mths	At the end of the follow-up, 35 patients (70%) in the corticosteroid group and 28 patients (53%) in the NSAID group had complete symptomatic resolution. No diff. in Quinnell score @ 3 mth, steroid better at 3wks	Quinnell Grade triggering @ Baseline, 3 wks, 3 mths					Although steroids gave quicker relief, NSAID injections are equally effective at 3 months in the treatment of trigger digits. We were unable to detect a statistically significant difference in the response of patients with and without diabetes to either treatment			110	40-75; 57/58 yrs	The inclusion criteria for the study were clinically diagnosed patients with trigger digits of at least grade 2 by Quinnell (that is, a painful jog during extension of the digit) and patients without previous treatment of the trigger digit	Quinnell Grade of triggering	
Park et al	2014	USA	Pros RCT	Methylprednisolone acetate	40mg/ml	1ml 1% lidocaine	VAS (anticipated); VAS (actual)	Before, during, after injection	Anticipated VAS pain scores were 45, 48, and 50 and actual VAS pain scores were 56, 56, and 63 for the vibration, control, and sham control groups, respectively.						Concomitant vibratory stimulation does not reduce pain experienced during corticosteroid injections for trigger finger.			90	59 yrs	The diagnosis of trigger finger was made by the attending physician based on a history of painful finger flexion and extension, symptomatic clicking or locking of the finger at the proximal interphalangeal joint, and the presence of tenderness over the A1 pulley		
Cecen et al	2015	Turkey	Pros RT CC	Methylprednisolone acetate	40mg/1ml		VAS	Baseline, 6wk, 6mth	After the corticosteroid injections, all patients improved significantly in terms of pain level and the Quinnell grading at 6 weeks and 6 months after the intervention in comparison to the pre-injection status. There were no significant differences between the groups. 9 patients (13 %) needed a second injection (6 of BIG, 3 of USG), all of whom had diabetes mellitus.	Quinnell grade triggering @ Baseline, 6wk, 6mth					The use of ultrasound-guided injection of corticosteroid may be associated with extra time and effort, with no superior clinical benefits compared to the blinded technique.	No adverse events	Ultrasound	74	54/55 years	Patients over 18 years of age, who presented with persistent or increasing complaints of trigger finger regardless of the severity or duration of their symptoms.		

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Liu et al	2015	Taiwan	DB RCT	Triamcinolone acetonide	10mg/1ml	VAS	Baseline, 3 wk, 3 mth		At 3 months, 12 patients (66.7%) in the HA group and 17 patients (89.5%) in the steroid group exhibited no triggering of the affected fingers (P=.124). The treatment results at 3 weeks and 3 months showed similar changes in the Quinnell scale (P=.057 and .931, respectively). The steroid group had a lower VAS at 3 months after injection (steroid 0.5 ± 1.1 vs HA 2.7 ±2.4; P<.001). The HA group demonstrated continuing significant improvement in MHQ at 3 months (change from 3wk: steroid 2.6 ±14.1 vs HA 19.1 ±37.0; P=.023; d=.78)	Quinnell grade triggering; TAM; JAMAR grip; @ baseline, 3 wk, 3 mth	MHQ @ baseline, 3 wk, 3 mth				Ultrasound-guided injection of HA demonstrated promising results for the treatment of trigger fingers. The optimal frequency, dosage, and molecular weight of HA injections for trigger fingers deserve further investigation for future clinical applications	No adverse events	Ultrasound	36	60-65yrs	The inclusion criteria for the study were patients with a clinical diagnosis of trigger finger of at least grade 1 on the Quinnell grading scale who were between 20 and 80 years of age.	Quinnell Grade of triggering	
Yildirim et al	2016	Turkey	RCT	Betamethasone dipropionate	0.5ml	2% Lidocaine	VAS	Baseline, 1, 3, 6 mths	Both groups demonstrated statistically significant improvements in all outcome measures after treatment. The intention-to-treat analyses showed no between group differences for cure rates, pain, and functional status at follow-up.	QuickDASH; Frequency of triggering (Likert); Quinnell grade @ Baseline, 1, 3, 6 mths					Extracorporeal shock wave therapy could be a non-invasive option for treating trigger finger, especially for those patients who wish to avoid steroid injections			40	54/55yrs	Patients older than 18 years of age and with grade 2 trigger finger based on the Quinnell classification	Quinnell Grade of triggering	